SCIENTIFIC AMERICAN

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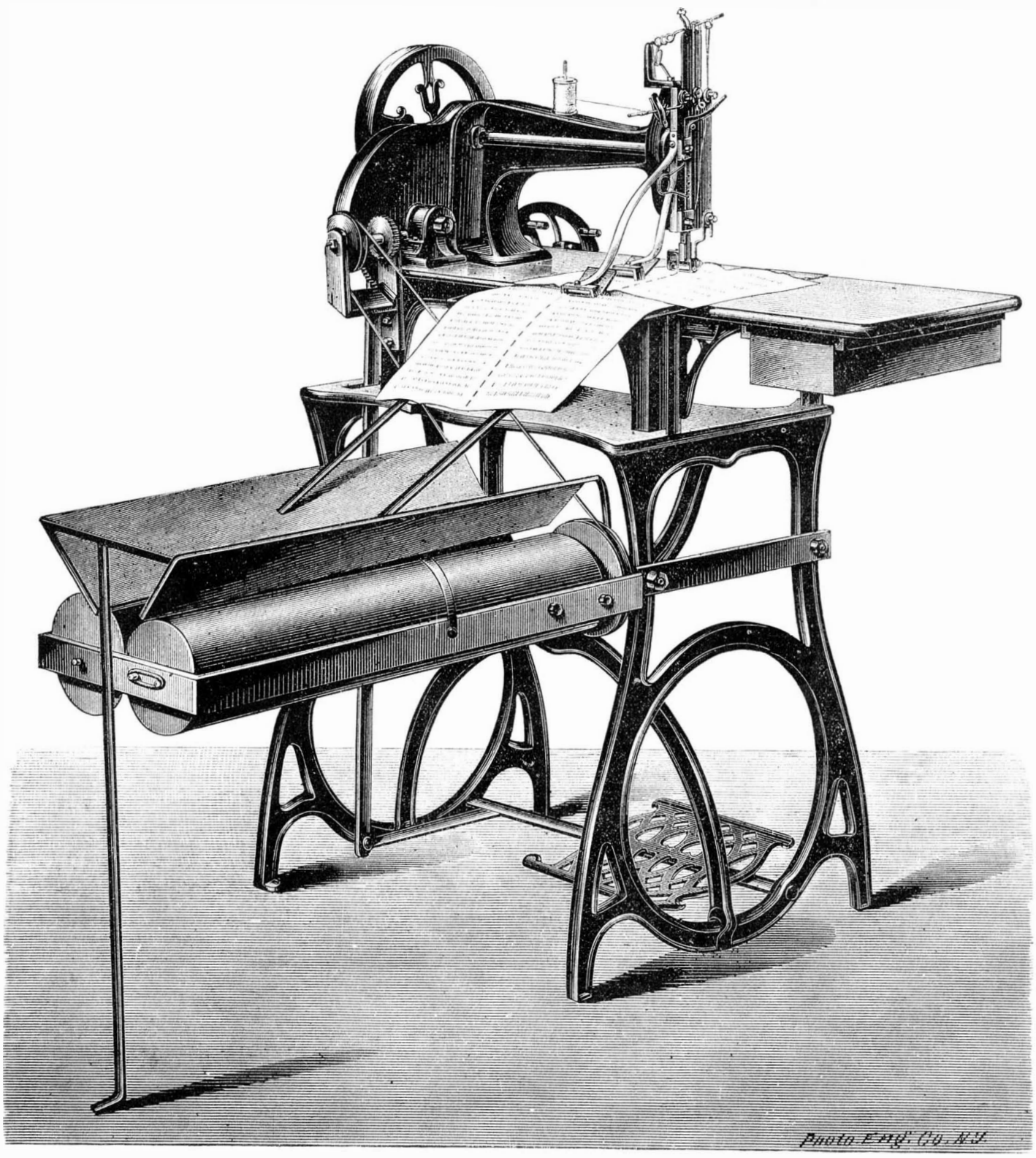
A BOOKBINDER'S SEWING MACHINE.

The Singer Manufacturing Company have recently adapted the principle of their sewing machine to the stitching of books and pamphlets; and we publish herewith an engraving of the book-sewing machine, in which all the parts are represented with such clearness that little explanation in necessary. The sheets of printed paper are first folded and then passed into the machine in succession. The attachment for effecting this is shown in our illustration; and it stitches the sheets, feeds them forward, cuts the thread, and conducts the sheets along downwardly inclined guides, so that they fall between two rolls, which fold and smooth them. The machine is capable of stitching sheets of any size or thickness; and however thickly the sheets may be folded, the rollers will give them the proper pressure, being united by an elastic connection which allows all thicknesses to pass through under their pressure.

The machine stitches the sheets with great rapidity; and as each sheet is stitched separately, the binder can get the sheets ready for binding as fast as they come from the printer, the sheets being afterwards collated for insertion in the covers. Much time is saved by this method, as every one familiar with bookbinding will acknowledge; and the separate threads to the sheets insure elasticity to the back, which allows the book to open easily, and so contributes in an important degree to the durability of the binding.



THE SINGER BOOK-SEWING MACHINE.

New Pavement.

A new kind of pavement has recently been laid in Newgate street, London; it has not been used for any roadway previously. About 300 superficial yards have been laid down at the west end of Newgate street. The following is the engineer's report on the material: "That the asphalt is stated to be composed of 85 per cent of fine ground granite and 15 per cent bitumen; that it is a material free from slipperiness and not affected by the atmosphere. It is laid in a heated, semi-fluid condition, two inches thick, upon a foundation of Portland cement concrete nine inches thick."

Construction of Petroleum Tanks.

Storage tanks, whether built by private enterprise or constructed in the interests of the pipe lines, are necessarily of iron. They must needs be of some such material in order to resist the pressure of enormous quantities of fluid intended to be stored within them. Their contents vary all the way from 8,000 or 9,000 to 25,000 barrels of 42 gallons each. These tanks are constructed of heavy iron, riveted together and made fluid tight in the usual boiler fashion. The first step, after the bed has been made by carefully compacting and leveling the ground on which the tank will rest, is to lay out the sheets which are to constitute the bottom on wooden horses properly arranged in the bed. These bottoms are then riveted together until a vast iron disk of the required diameter is produced: the diameter in the case of a 20,000 barrel tank, for instance, being about 80 feet. It is calculated in a rough way that the bottom of the tank, with the first ring of siding attached, is chargeable with half the cost of the whole tank. This first ring is attached to the bottom by means of a number of L-shaped pieces, to which these parts are respectively riveted. The remaining rings are attached or built up in the usual boiler fashion. At the proper time the wooden bases are withdrawn; and by means of jack screws or some similar device, the tank is let down upon its earthen bed. The roof is either of iron or of wood. Iron roofs are sometimes constructed of something akin to ordinary roofing metal, properly supported by a frame within, if the tank be small; but if it be large, the roof is generally constructed of heavier sheets, riveted together. The vast majority of tanks have wooden roofs. Out of 85 examined recently, only 18 had iron tops. Wooden roofs are generally tarred and graveled. Sometimes, instead of being flush with the top of the tank, they are set some inches below it, forming a water top intended to hold water. Sometimes they are covered with earth, in which vagrant grass seeds taking root, the roof presenting somewhat the appearance of turf. These are the earth tops.

Every roof has a manhole, generally upon the principle of an ordinary house scuttle. It affords access to the interior of the tank for cleansing and other purposes. There is a supply pipe which runs up the side of the tank and enters at the top, near the manhole. About an inch or so above the bottom, one or more drawing-off pipes are inserted. Access to the roof is secured by a wooden ladder or steps; these are generally permanent attachments. Across the roof, be it of wood or iron, a slatted or cleated wooden walk is provided, so that the roof may not be injured by being trodden upon. Sometimes, if tanks are near together, their roofs are connected by wooden bridges or plank ways, that easy access may be had to all. Sometimes the base of tank is earthed up for three or four feet with sloping banks of gravel.

Sometimes a trench two feet in depth is dug about the base, with an opening towards the downwards slope of land. When the tank is completed, it is subjected to an hydraulic test; water to its full capacity is pumped in; and if the tank bears this strain without either bursting or leaking, it will of course withstand the pressure of an equal quantity of oil. Occasionally the water pressure proves too strong, particularly if the iron has not been of a good quality. The tank, now completed, receives its contents through the supply pipe the oil coming through, it may be, miles of piping, either direct from the wells or from other tanks or from barges laden with the oil in bulk. In this way the oil-producing country is threaded with countless miles of piping, sometimes above ground, sometimes on or beneath its surface, and sometimes in the beds of rivers.

Some tanks are on the tops, others on the sides or in the hearts of mountains, others at their base. Sometimes they cluster together in particular localities by the dozen. Frequently we find knots of tanks, only from five to ten feet apart: hence all morally certain of destruction by the fire that seizes upon any one of them. On the other hand, where wiser foresight has prevailed—as on the Anchor Farm, Chestnut Hill, opposite Parker's—it is made obligatory upon tank owners to build at least 200 feet apart. There are twelve tanks upon the summit of this hill. At Mount Nebo, just south of Parker, there are ten tanks separated by distances varying from 100 to 150 feet; while at Montrose there are ten new tanks being built on the river bank, separated from each other by only fifty to seventy-five feet.—*W. S. Newall.*

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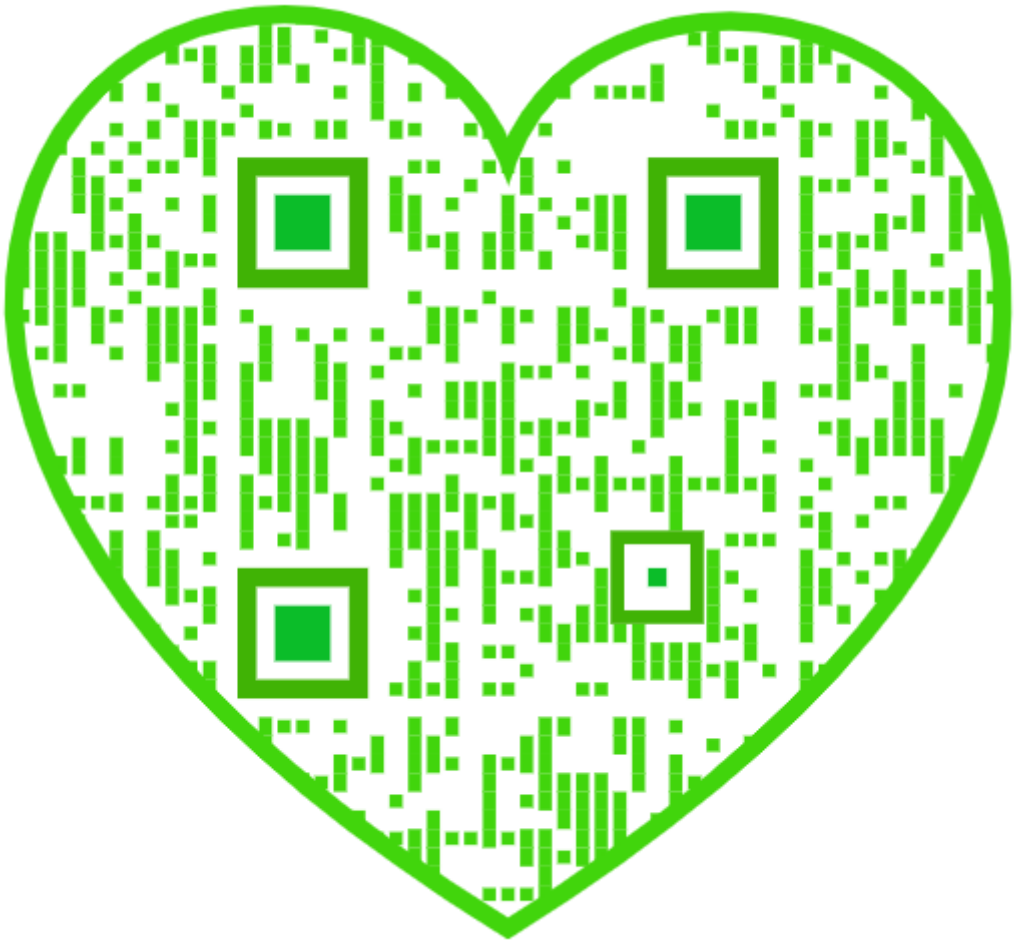

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Contents.

(Illustrated articles are marked with an asterisk.)

American Institute fair, the..... 233
Ammonia, making (49)..... 236
Aniline colors, the (47)..... 236
Answers to correspondents..... 235
Apple butter (51)..... 236
Austrian curiosities, two..... 232
Baroscope, making a (24)..... 235
Belt, the largest machine..... 226
Bluing stains (39)..... 236
Boats, proportions of (15, 18, 20).. 235
Boiler composition, new..... 233
Boilers, horse power of (10)..... 235
Business and personal..... 235
Carbolic acid in tar, etc. (48)..... 236
Carbon disulphide, antiseptic..... 230
Carbonic acid in the sea (6)..... 265
Cedar, imitation (3)..... 235
Cement, acid-proof, 225, (23)..... 235
Cement, ink-proof (24)..... 235
Centennial notes..... 232
Charcoal, burning (4)..... 235
Cinchona..... 232
Clock running too fast (2)..... 235
Clouds, manufacture of..... 227
Coal, spontaneous combustion of. 225
Coal, waste of, by smoke..... 232
Copper, Lake Superior (44)..... 236
Cores*..... 228
Cowrie copal, dissolving (5)..... 235
Dollar mark, the (50)..... 236
Drilling machine, car frame*..... 226
Dutch agricultural exhibit, the... 232
Dyeing straw hats (42)..... 236
Engines for boats (18, 20)..... 235
Engine, the smallest steam..... 232
Ferro-tartaric acid (38)..... 236
Fibers, Spanish..... 232
Flax manufacture, American..... 227
Furs, cleaning (43)..... 236
Furs, Russian..... 232
Gearing, a new*..... 226
Gloves, stains on (7)..... 235
Heat and air compression (26).... 235
Heat in water, etc. (12)..... 235
Hell Gate explosion, the..... 226
Horse, swimming a..... 226
Hospital construction, new..... 227
Humming tube, a (46)..... 236
Huxley's lectures in America..... 224
Ice, heat transmission through (14) 235
Ironwork, mediæval*..... 227
Jacquard, the loom inventor..... 227
Kerosene stains on marble (29)... 235
Larvæ, rat-tailed..... 228
Leather, dyeing (35)..... 235
Link block, locomotive*..... 230
Liquid for high temperatures..... 227
Locomotive boilers, expansion of 228
Machinery at Institute fair..... 233
Manganese..... 226
Masts of ships (17)..... 235
Meat, American, in Europe..... 230
Mechanical movement, new*..... 230
Mercury on polished iron (18)..... 235
Metal for lining boxes (21)..... 235
Metal with rubber, coating (41)... 236
Microscope, a sermon by the..... 225
Millstones, staffing paint for..... 235
Mining exhibit, Belgian..... 232
Molds, plaster of Paris (27)..... 235
Moon and the weather, the..... 226
Naval items..... 229
Nitrate of silver, substitute for... 235
Ornithological ornament, an*..... 227
Ozone an active poison..... 227
Patent business in England..... 233
Patent decisions, recent..... 233
Patents, American and foreign... 233
Patents, official list of..... 236
Pavement, new..... 223
Petroleum tanks, constructing... 223
Picric acid in dyeing (36)..... 236
Potato starch, to make (2)..... 235
Pottery at American Institute fair 233
Practical mechanism—No. 11*..... 228
Pressure and cut-off (32)..... 235
Pump, a wooden (10)..... 235
Pumping water (14)..... 235
Quicklime and plaster (37)..... 236
Railroads in the United States.... 230
Rails, proportions of (31)..... 235
Rambling notes—No. 1..... 232
Rhodonite, Russian..... 232
Saw files..... 231
Sea, the, why it is salt..... 265
Self-oiling boxes..... 233
Sewing machine, bookbinder's*.. 223
Shafting, hangers, and pulleys... 232
Soldering fluid, gas from (22)..... 235
Spoons, wooden..... 226
Steam, condensing (19)..... 235
Stop valve, improved*..... 230
Tallow, to purify (9)..... 235
Tallow, vegetable..... 232
Tanned skin, sun (1)..... 235
Tar from woolen cloth (3)..... 235
Tension devices, uniform (16).... 235
Tuning fork, lowering tone of (30) 235
Tunnel, the new Thames..... 227
Vines for winter decoration*..... 231
Water, head of, and pipes (35).... 235
Water wheels and their makers... 232
Wood preservatives..... 225
Woods, tropical..... 232
Woodworking machinery, etc..... 231
Writing fluid (34)..... 235
Yellow fever epidemic, the..... 226

THE SCIENTIFIC AMERICAN SUPPLEMENT.
Vol. II., No. 41.
For the Week ending October 7, 1876.

TABLE OF CONTENTS.

I. THE INTERNATIONAL EXHIBITION OF 1876.—The Russian Artillery Exhibit. New Russian Field Gun.—The Elastic Recoil.—Tank Locomotive, 5 figures.—Connery's Concave Calking for Boilers, 2 figures.—Mineralogical and Archæological Displays.—Illinois Minerals, Crystals, Ores, Woods, and Ancient Remains.—Pennsylvania Exhibits of Coal and Iron, Geological Models, Lithological Specimens, Remarkable Exhibits of Great Coal Specimens, Exhibits of Manufactured Iron, Galvanized Iron, Fire Brick, Marble, etc.—Interesting Exhibits from Michigan.—Great Specimens of Native Copper, Beautiful Exhibits of Silver, Specimens of Sandstone, Glass Sand, Grindstones, Slate, Salt, etc.—Wonderful Mineral and Fossil Exhibits from Missouri.—Large Blocks of Coal from Ohio, Ohio Salt, Bromine, Lampblack, Pottery, Indian Antiquities, etc.—Rich and Remarkable Exhibits from Wisconsin, Iowa, Indiana, Delaware, Vermont, Kentucky, Tennessee, Virginia, and Alabama.

II. ENGINEERING AND MECHANICS.—How to Make Steam and Water Joints, by JOSHUA ROSE.—Peyer's Steam Trap, 2 figures.—New Steam Condenser without Air Pump, 3 figures.—New Office Water Gage, 2 figures.—Ship Canal Nicaragua, between the Atlantic and Pacific.—Improvement in Canal Banks, 5 figures.—The Seismagraph, an Instrument for Recording Railway Oscillations and Stocks, 2 engravings.—Brown's System for Automatic Railway Signals, 4 engravings.—New Direct-Acting Compound Steam Pumping Engine, 3 engravings.—Thurston's Torsion Machine and Experiments.

III. ELECTRICITY, SOUND, ETC.—The Gramme Electric Machine, with 4 figures. By BROWN AYRES. Explanation of Theory and Practical Construction.—Change of Volume of Electric Conductors.—Acoustic Attractions.

IV. TECHNOLOGY.—Sublimed Salicylic Acid.—Tinfoil for the Teeth.—Health of Dentists.—Jet Mining and Working.—Uses of Rushes.—Trade and Manufacture in the United States.—The Lowe Gas Process in Philadelphia.

V. LESSONS IN MECHANICAL DRAWING, by Professor MACCORD, 2 pages of illustrations.

VI. NATURAL HISTORY, ETC.—Professor HUXLEY'S First Lecture in America, on the Theory of Evolution.—The Order of Nature in the Past.—The Three Existing Hypotheses.—The Hypothesis of the Eternity of Matter.—The Miltonic Hypothesis.—The Hypothesis of Evolution.—Circumstantial Evidence in Favor of the Latter.—Diatoms, with 5 illustrations.—Corals from the Peruvian Andes.—Course of Brain Fibers.

VII. ASTRONOMY.—Observations on the Planet Saturn, by L. TROUVELOT 2 engravings.—Different Levels of Saturn's Rings.—Recent changes in the Dusky Rings—The Clouds and Color of Saturn.

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PROFESSOR HUXLEY'S LECTURES IN AMERICA.

During Professor Huxley's recent brief sojourn in America, he delivered three lectures (the only scientific discourses given by him in this country) on "The Theory of Evolution." They were spoken at Chickering Hall in this city, on the evenings of September 18, 20, and 22, before large and appreciative audiences.

There was a shade of disappointment visible on the faces of not a few of Professor Huxley's hearers as they left the hall at the close of his first lecture. It had not been at all what they had come to hear. The absurd reports which certain of the daily newspapers had circulated with regard to Professor Huxley's attitude toward religion had led many to anticipate something startling. As the "arch enemy of Christianity," he could not do otherwise than run a-muck with Genesis, and say things very offensive to the orthodox. So, when the speaker finished his calm, straightforward, logical, and perfectly reasonable review of the three conflicting theories of the origin of animal forms, a discourse in which there had been no exciting language and no effort to say smart things, they were disappointed, and inclined to blame him for not being the sort of man they had come to see. Others, unable through lack of a knowledge of the subject in hand to appreciate the masterly manner in which Professor Huxley clove to the heart of the matter, and quietly took possession of the much contested field, missed the real point of the lecture, and came away half persuaded that somehow they had been imposed upon. Anybody, they complained, could have said the same, and more than one popular speaker known to the American platform could have said it more eloquently. Still another class, and that, we fear, not a small one, shared the disappointment, namely, those who had but a vague idea of the scope and purport of geological evidence, and no idea at all of the enormous mass of facts bearing directly or indirectly on the theory of evolution, who yet expected to be told, in course of an hour, precisely how everything came about. Judging from remarks we overheard among the retiring audience, more than one of this class must have come away feeling that the lecture had been altogether different from what it ought to have been.

To those, however, who understood the situation of affairs, and were prepared to appreciate the beauty and success of the method which Professor Huxley chose for clearing the way for an unobstructed view of the evidence bearing on the problems of evolution, to be set forth in succeeding lectures, the first evening's discourse was as satisfactory as an introductory lecture well could be. Particularly happy was the cornering of the Biblical theory of creation in "Paradise Lost." There the creation of living things is described precisely as all men read it in Genesis before geological revelations compelled theologians to vary their interpretation of the Scriptures, as occasion might require. The utter inconsistency of the "Miltonic hypothesis," tested by the geological record, both as regards the manner and the order of the origination of plants and animals, was shown most conclusively; but the lecturer declined to commit himself in any way by calling that view of creation the Biblical view. It was true that Milton's account of the six days of creation was considered to be in perfect accordance with Genesis, by all Biblical scholars of his day, and for nearly two centuries thereafter. It was true that that interpretation had most likely been taught as scriptural, in childhood, to everyone of his hearers. But Professor Huxley would not for a moment venture to say that it could properly be called the Biblical doctrine.

In the first place, it was not his business to say what the Hebrew text contained, or what it did not, and in the second place, were he to say that this was the Biblical hypothesis, he would be met by the authority of many eminent divines, to say nothing of men of Science, who in recent times have denied that this doctrine is to be found in Genesis at all. Each finds in the Biblical record just what he requires to make it harmonize with his particular scheme of geology: *day* may mean twenty-four hours, or a period as long as convenience requires; the creation of a species may be direct and immediate, or, according to the same record, the species may have been evolved from simpler rudiments by natural processes, lasting millions of years. When the accredited interpreters of Scripture could come to any agreement with regard to what the Biblical account really meant, it would be time enough to compare Genesis with geology: meantime "a person who is not a Hebrew scholar can only stand by and admire the marvelous flexibility of a language which admits of such diverse interpretations." The applause which followed this remark was evidence enough that the majority of the audience were in sympathy with the speaker.

The second lecture was devoted to the consideration of two lines of geological evidence, the first including such facts as are neutral, which neither help evolution nor are inconsistent with it; and the second, those facts which give strong probability to the theory but do not prove it. A third line of evidence—that which, being as complete as any we can hope to obtain on such a subject, and entirely in favor of evolution, may fairly be called demonstrative of evolution—was reserved for the third and last lecture.

Historically important among neutral facts are those which led Cuvier to pronounce against the theory of evolution as propounded by Lamarck. The French expedition to Egypt had brought from that country the mummied remains of many animals, mammals, birds, and reptiles. Cuvier argued that, if evolution were true, the Egyptian remains, which were certainly three or four thousand years old, ought to be measurably unlike the birds, crocodiles, and so on, now inhabiting the valley of the Nile. He found on close examination that three or four thousand years had brought no important change to the animal forms of that region, and accepted the evidence as conclusive against the doctrine of Lamarck. The progress of research since Cuvier's time has furnished far stronger cases than those which he drew from the mummified bodies of Egyptian animals. As we work our way through the geological record, we find at every age, even the remotest, animal forms scarcely distinguishable from those which now exist. We also find great groups of animals, like the reptiles of the mesozoic period, abounding in vast numbers in strata representing periods of immense duration, yet presenting no important modification from first to last. Facts like these are often cited as fatal to the theory of evolution; but they are not at all in conflict with an intelligent view of that theory, though they *are* "fatal to any form of the doctrine of evolution which supposes an intrinsic necessity, on the part of animal forms which once come into existence, to undergo modification; and they are still more distinctly opposed to any view which should lead to the belief that modification in the different types of animal and vegetable life goes on equally and evenly." There is a manifest tendency on the part of living forms to vary; but whether such variations persist and accumulate, or die out sooner or later, depends altogether upon surrounding conditions. The persistence of old forms simply shows that they are better fitted for the conditions under which they flourish than any modifications of those forms have been; and that, since their origin, the earth has not failed to furnish somewhere just such conditions. Facts of such a character, and they are numerous, furnish no objection to evolution, nor any support to it; they are simply neutral, though perfectly capable of being interpreted in consistency with it.

Of like nature are the numerous facts showing the apparently sudden origin of forms, like the permian lizards, with no trace of antecedent forms. Such facts would be fatal to the evolutionary theory, if the geological record as it stands were complete. But the exceeding incompleteness of the record is a necessary condition from the manner of its formation; and besides, there is abundant evidence of enormous gaps. A striking illustration was furnished by the Brontozoum tracks in the sandstones of Connecticut—the only vestiges thus far discovered, or likely to be discovered, of the numerous and varied order of (probably) reptilian life which for a long period inhabited the shores of the ancient sea which existed there. That we have even so much as a footprint to hint of that mysterious horizon of life depends on the purely accidental circumstance that the sand, since hardened into rock, was accumulating under conditions which allowed the tracks to be preserved.

Much more interesting, on the whole, was the evidence in favor of evolution derived from transitional forms, or, more correctly, forms standing between groups now distinct, and partaking of the characteristics of each. For the most part, the evidence of this sort was drawn from recent discoveries tending to fill up one of the largest gaps in existing animate nature, that between reptiles and birds, and hinting how the evolution of birds from reptiles may have taken place. The evidence embraced an array of facts, of a fresh and intensely interesting character, relating to the *archeopteryx*, a feathered animal, bird-like in most respects, but having clawed wings and a reptilian vertebral column, prolonged into a long slender tail fringed with feathers: to *Hesperornis regalis*, a grebe-like bird six feet high, with a long jaw thickly set with teeth; to *ichthyornis dispar*, a still more reptilian bird, with teeth in distinct sockets; and to the bird-like modifications of dinosaurian reptiles, culminating in the *compsognathus longipes*, a type, possibly, of the reptilian bipeds which made the mysterious tracks found in Connecticut and in similar strata in England.

The third and final lecture was begun by pointing out an element of weakness in the evidence presented in the preceding lecture. It was true the mesozoic rocks furnished fossil forms so completely bridging over the gaps between reptiles and birds that it would be very hard to say where the reptile ends and the bird begins. It was true that evidence of that sort is far weightier than that upon which men undertake to say they believe many important propositions. But it could not be considered demonstrative evidence, for the reason that the intermediate forms were found in contemporaneous deposits, whereas the requirements of demonstration demand that the gradations between one group of animals and another should appear in such order as they must have followed if they had constituted a succession of stages, in time, of the development of the form at which they ultimately arrive. Such demonstrative evidence has been obtained in late years in considerable and continually increasing quantity. Indeed it is somewhat surprising how large is the quantity of that evidence and how satisfactory is its nature, when we consider the exacting character of the condition of its preservation and discovery. As an illustration of that kind of evidence, the discoveries with regard to the pedigree of the horse were chosen as specially appropriate for the attention of a popular audience. The readers of the SCIENTIFIC AMERICAN are already familiar with the geological evidence on this point, as set forth in the article entitled "The Genesis of the Horse," in No. 16, volume XXX. The long and admirably sustained argument of Professor Huxley will be found in a full report of the three lectures in the current issues of the SCIENTIFIC AMERICAN SUPPLEMENT.

Having traced at great length the evolution of the horse from the four-toed horse-like creature of the eocene period, and showed that the history of the horse, as recorded in tertiary strata, is precisely that which could have been predicted from a knowledge of the principles of evolution, the lecturer said: "If that is not scientific proof, then there are no inductive conclusions which can be said to be scientific.

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And the doctrine of evolution at the present time rests upon as secure a foundation as the Copernican theory of the motions of the heavenly bodies."

In closing, the speaker took the precaution to observe that his purpose had not been to enable those who had not made a study of these subjects to leave the room in a condition qualified to decide upon the validity or the invalidity of the hypothesis of evolution, but to put before them the principles by which all such hypotheses must be judged, and to make apparent the nature of the evidence and the sort of cogency which is to be expected and may be obtained from it: and he should consider that he had done his hearers the greatest service it was in his power to do, if he had convinced them that the question under discussion was not one to be dealt with by rhetorical flourishes or by loose and superficial talk, but one that requires the keenest attention of the trained intellect and the patience of the most accurate observer.

A SERMON PREACHED BY THE MICROSCOPE.

The mineral polishing powder lately brought into use under the name of electro-silicon consists, as shown by the microscope, entirely of silicious or flint shells of the *diatomaceæ*, species *epidiscus*, each shell being a flat disk. We recently measured their diameters and found them to average $\frac{1}{2000}$ inch, while the thickness was $\frac{1}{8000}$ inch. Therefore, when piled up like coin (and in this way they appear in the mineral), 8,000 of these are one inch thick; while a square inch can contain more than 2000x2000, or over 4,000,000, such disks; and the number present in every cubic inch is thus more than 8000x4,000,000, or over 32,000,000,000. When we consider that the thickness of the deposit in Nevada, where this mineral is found, is reckoned in hundreds of feet, and the length by hundreds of miles, we can only be struck by the immensity of the organic creative power with which the atoms of matter are endowed, a power which forms these atom-like objects, in regular shape and in numbers to be counted, not by millions of millions, but by countless myriads. Not this alone: but this power also ornaments most of the species in the most tasteful and intricate manner: an ornamentation which is revealed only by the most powerful microscope.

When we were once visiting the cathedral of Strasbourg, Germany, an architect in our company made the remark that the artisans who cut the ornamental stones had expended just as much care in giving the utmost finish to the highest parts at the top of the spire, where scarcely ever any one had a chance to admire their admirable workmanship, as to every part of the cathedral below, where it is daily seen by the worshippers. "But," said our friend, "those men labored not so much for their wages as they do now a days (often trying to cheat in the value of their work when they have a chance); but in those good old times, every artisan labored for the glory of God; it was a species of religious enthusiasm which induced them to finish their work there as conscientiously as anywhere else, although it could only be seen by God."

Considering the discoveries of the exquisite ornamental finish of those little objects belonging to the hundreds of species of *diatomaceæ*, what is more natural than that the religious enthusiasm of the mediæval church builders is taking hold of the microscopists of our day, who really are enabled to see what God wrought thousands of centuries before it could be seen by any human creature? And these wonders have waited through all these ages before the fact could be appreciated and acknowledged; that the creative power is infinitely great, even in the infinitely small.

WHY IS THE SEA SALT?

According to Professor Chapman, of University College, Toronto, the object of the salting of sea water is to regulate evaporation (see page 98, current volume). This suggestion does not answer the question: why, or by what cause, the sea became so salt; but it assumes to tell us wherefore or for what object the sea is salt. The cause of the saltness should be answered first; and if, after we have ascertained this, it is proved that the salting accomplishes a secondary ultimate purpose, the other question arises. But we believe that a careful consideration of the Professor's hypothesis will quickly expose its fallacy.

In the first place, then, the sea is salt as a simple and necessary consequence of the fact that it must contain all the soluble matter which the rains have washed out of the most exposed portions of the earth's crust, and which the rivers have carried, and are still carrying, to the ocean. And as the rivers do not carry water as pure as that which evaporates from the sea, because they all, without any exception, carry various salts in solution, which can never be raised from the ocean by evaporation, the sea has, in the course of ages, become more and more salt; and the process is still going on. Such a nice regulation of the amount of evaporation as the Professor suggests is quite unnecessary, as it is well known that the regions under the influence of the evaporation of our large fresh water lakes are not much different in agricultural value or sanitary conditions from those under the influence of salt water evaporation, the sole conditions for agricultural success being, next to the nature of the soil, a liberal supply of moisture and solar heat; while in a sanitary point of view, a moderate supply of both is more desirable.

We must, however, give credit to Professor Chapman for his experiments; he proved that the amount of evaporation of fresh water, compared with that of salt water under the same circumstances, may differ largely; so that the evapora- becomes less and less, in proportion as the relative amount of salt increases. But we would give this fact an interpretation different from that of the Professor. In the condition of things preceding the carboniferous era, when the rivers had not yet dissolved so much saline matter out of the exposed earth's surface, nor the rivers carried it to the seas, the ocean necessarily contained much less salt than at present; therefore the amount of evaporation must have been much larger. This condition of things was not favorable to animal existence but it was to vegetable life; and this may partly explain the excessively luxuriant vegetable growth which was the parent of our coal deposits. When in the course of ages the ocean became more salt, the evaporation became less; the air was not so continually overcharged with moisture, and was more favorable to animal life. If the saltness has since increased continually, and the dryness of the air has augmented in proportion, we must not be surprised that regions of the earth, once fertile and inhabitable, have become dry deserts. We know this to be the case with the lands on which Babylon, and Palmyra, and other cities, were situated, which, as well as the whole of Upper Egypt, Palestine, etc., were formerly more fertile than they now are, considering the dryness of their atmosphere. In order to become convinced of the influence of moisture on vegetation, one needs only to visit the dry highlands of New Mexico and Colorado, and compare the vegetation there with the moist southern part of Louisiana. If we take the former in summer, and the latter in winter, so as to have the same temperature in both, the difference will be obvious and remarkable.

THE SPONTANEOUS COMBUSTION OF COAL AT SEA.

An intimation of the fearful aggregate of suffering entailed by frequent losses of ships by fire at sea is given in the fate of the crew of the San Rafael, intelligence of which has just been received. The San Rafael, of Liverpool, with a cargo of coals, was bound for Valparaiso: off Cape Horn she took fire; her crew escaped in three boats, two of which, with eleven persons, were picked up by a passing vessel after a period of dreadful suffering. The third disappeared, to be heard of no more until a party of seal-hunting natives reported to a missionary cruiser the discovery of the remains of eight men and one woman on a desert island near the cape, where they had perished with starvation. The instruments and papers found with them proved them to be the missing members of the San Rafael's crew. The details of their terrible fate have been given in the daily newspapers: the occasion of it, namely, the spontaneous combustion of coal at sea, its causes, and the means that may be adopted for preventing such disasters, are what we wish to call attention to here.

The frequency of such casualties has given rise to many enquiries by boards of trade and others, who have quite uniformly recommended ventilation as the best means of prevention. But experience shows that the more and better the ships were ventilated, the more frequent were the fires. On one occasion, four ships were loaded at Newcastle at the same time, with the same coal, from the same seam. Three of the ships, bound for Aden, were thoroughly ventilated: the fourth, for Bombay, was not ventilated at all. They were each carrying from 1,500 to 2,000 tuns of coal. The three ventilated ships were totally lost by spontaneous combustion; the fourth brought her cargo safely to port.

Repeated occurrences of this sort could not but shake the faith of shippers and underwriters in the saving efficacy of ventilation. A royal commission, made up of men like Dr. Percy and Professor Abel, was thereupon appointed to enquire into the matter, and their report, recently laid before Parliament, amply demonstrates the impolicy of ventilating cargoes of coal, especially for long voyages across the tropics; and points out clearly the conditions which lead to spontaneous combustion. Prominent among these is the development of heat due to chemical action, arising from the oxidation of substances contained in the coal. The best known of these are the combinations of iron and sulphur called iron pyrites. Moisture in the air facilitates this oxidation, which is accompanied by the development of heat, often intense enough to set the coals on fire. Obviously any increase of ventilation serves only to increase the vigor of the chemical action, and too often to ensure the destruction of the vessel. Another source of danger lies in the capacity of finely divided or porous carbon for absorbing and condensing within its pores large volumes of oxygen and other gases, with an attendant development of heat; moreover, the tendency to oxidation, which carbon and certain of its compounds possess, is favored by the condensation of oxygen within its pores, whereby the closer contact of the carbon and oxygen particles is promoted. Hence, the development of heat by absorption and the setting up of oxidation occur simultaneously; and as the heat increases, oxidation proceeds more and more energetically until the carbon is heated to the igniting point. The breaking up of the coal before and during shipment, by rough usage, favors this process.

The risks of spontaneous combustion are largely increased by the length of the voyage and the bulk of the cargo. For the most part fires occur in vessels carrying over 500 tuns, bound for the West Coast of South America, San Francisco, and Asiatic ports beyond the Mediterranean and Black Seas. Of such shipments four per cent were lost in 1874; and though they amounted to only 1,181 out of a total of 31,116 coal shipments to foreign ports, more than five sevenths of the fires occurred among them. There were seventy casualties of the sort in all, of which only ten occurred in shipments to European ports. The excess of fires by spontaneous combustion on long voyages seems all the more striking when we contrast the bulk of the European shipments—over ten and a half million tuns of coal—with the shipment of less than three million tuns to Asia, Africa, and America. And, as already remarked, the best ventilated vessels suffered most from these disasters.

Properly the conclusions of the commission are averse to ventilation in the cargoes of coal ships. They also point out that certain coals are intrinsically dangerous for shipment on long voyages: also that it is dangerous to ship pyritic coals wet, and coals much broken up in mining and transportation.

In the course of the enquiry, a curious and unexpected circumstance was revealed, showing the far-reaching effects of social changes and improvements. Arthur Helps would have been charmed with it. No two things would seem to to be more remote and independent of each other than the increase of schools among the poor and the increase of fires at sea: yet the latter seems in a measure directly due to the former. In this way: The presence of iron pyrites in coal is one cause of spontaneous combustion in coal cargoes. At the mines, boys were formerly employed to pick the "brassy lumps" out of the coal. The first effect of the Education Act was to withdraw those boys from the coal chutes and send them to school. The pyrites were no longer picked out; and straightway a remarkable increase occurred in the burning of coal ships at sea!

THE YELLOW FEVER EPIDEMIC.

Telegraphic reports from Savannah, on the 23d September, state that over two thousand people are stricken with yellow fever in that city, and eight thousand more are appealing to the country for relief and for means of preventing the spread of the infection. The disease has broken out in Charleston, and it is feared that it will extend its ravages to other Southern cities. Several cases have already occurred in Baltimore. There is a widespread feeling of concern lest, before the autumn frosts, the malady will gain a foothold in the more thickly populated cities of the Middle States. The probabilities and known features of the disease, however, all tend to remove, in this last respect, the ground for alarm. Yellow fever is not contagious from person to person, and its occurrence serves only to mark the presence of its special cause, which is generated outside the human body. The conditions for its existence must be such as are favorable to the germs which develope after being received into the system. The germs, however, are capable of being transported in infected vessels, clothing, and merchandise, and herein lies the chief danger. Militating against this are the rigid quarantine regulations which will be enforced, and the fact that the first frost to which they are subjected instantly destroys the organisms. On the other hand the disease, even when imported out of its indigenous region, is greatly promoted by auxiliary causes, such as overcrowding, defective drainage, filth, and similar negligence in sanitary precautions. It will be seen, therefore, that the prevention of the epidemic is even more in the hands of the people individually than in those of the authorities; and the importance of every person assuring himself that his immediate surroundings are in clean and healthy condition is evident.

We have so frequently pointed out the way to avoid filth diseases that it is difficult to write anything other than repetition of previous advice. We have before us the latest and best work on the subject, "Filth Diseases and their Prevention," by Dr. John Simon, F.R.C.S., and beyond all else the author states that impure water is the "chief way by which filth infections get entry into the human body." Shallow wells in thickly populated regions, he mentions as especially dangerous; and wells adjacent to privies and other filth deposits are the chief means by which enteric fever spreads in such neighborhoods. Old moldy dust heaps, wet house refuse awaiting removal, the filth of ill kept streets, leaky drains, and traps not gas tight and not freely ventilated, are other prolific causes of disease. The best disposition of house refuse, swill included, is to burn it; and carbolic acid, chloride of lime, copperas, and other cheap disinfectants should be freely employed in privies, cellars, stables, and outhouses. Filtering bad water is of little avail; where there is none other to be had, boiling with a lump of charcoal in the vessel is a good precaution.

The suffering in Savannah is augmented through lack of money to provide for the care of the sick, and there is an urgent demand for prompt assistance. Subscriptions are being raised by many organized bodies in this and other Northern cities. We trust that the call will meet a most generous response. Money may be transmitted to Hon. W. H. Wickham, Mayor of New York city, who will forward it to the Savannah authorities. We appeal to all who can afford it to do something for the sufferers, and to do it at once.

Wood Preservatives.

According to observations made on a railroad in Germany, the proportion of renewals was, with oak sleepers (not treated) after 12 years of service, 74·48 per cent; with oak sleepers, treated with chloride of zinc, after 7 years, 3·29 per cent; with oak sleepers, impregnated with creosote oil, after 6 years, 0·09 per cent; with pine sleepers, impregnated with chloride of zinc, after 7 years of service, 4·46 per cent. The practice of this railroad, since the year 1870, has been to employ only oak for sleepers, which are impregnated either with chloride of zinc or with creosote oil.

MR. C. K. WOOD wishes us to state that he intended to write that Professor Airy's clock gained 2¼ seconds, not 274 seconds, in his letter on the weight of a body inside a hollow sphere, published on page 196 of our current volume.

A GOOD acid-proof cement is made by mixing a concentrated solution of silicate of soda with powdered glass, to form a paste. This is useful for luting joints in vessels exposed to acid fumes

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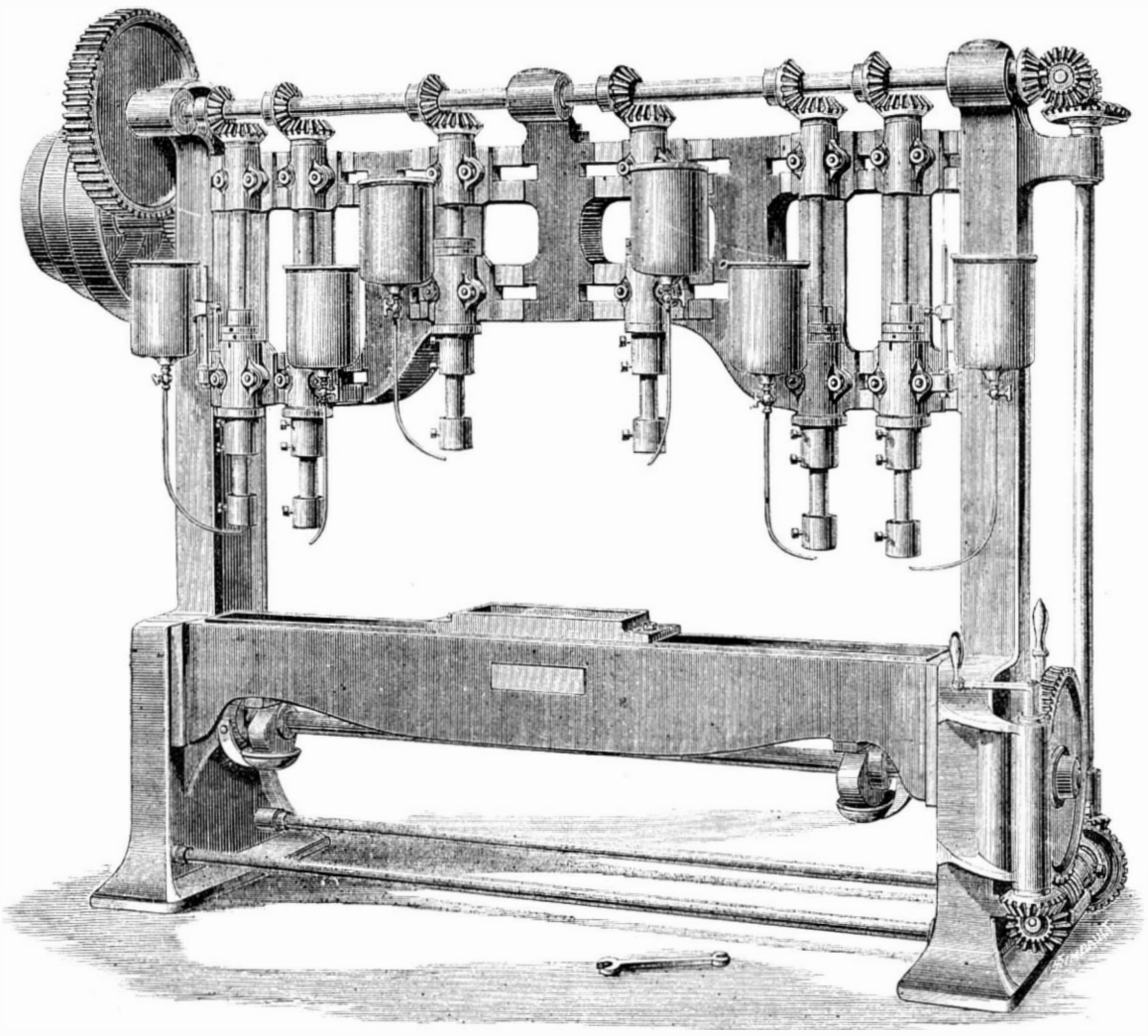
CAR TRUCK FRAME DRILLING MACHINE.

We illustrate herewith a special tool manufactured by Messrs. W. B. Bement & Son, of Philadelphia, Pa., for drilling at one operation the different holes required in car truck frames. The frame to be drilled is laid upon the table shown, and held there in position, the table, with the frame plate upon it, being then fed up to the drills. This table can be raised either automatically or by hand through the gearing shown. The drills are mounted on an upper frame, at the standard distance apart, and are driven by gearing from the coned pulleys. The drill spindles slide in the vertical holders, which are tubular, and they can be locked in any desired position by the set screws at the ends of the holders. The drill spindles can be adjusted on the cross frame to different distances apart so as to suit different patterns of car frames. The tool is well designed; and where a number of frames have to be drilled to one pattern, it is a very useful one, and capable of turning out a great deal of work.—*Engineering.*



CAR TRUCK FRAME DRILLING MACHINE.

The Moon and the Weather.

A writer in *Blackwood's Magazine* derides the popular error that the moon produces any effect upon the weather, as follows:

The notion that the moon exerts an influence on the weather is so deeply rooted that, notwithstanding all the attacks which have been made against it, it continues to retain its hold upon us. And yet there never was a popular superstition more without a basis than this one. If the moon really did possess any power over the weather, that power would be exercised in one of these ways: by reflection of the sun's rays, by attraction, or by emanation. No other form of action is conceivable.

Now, as the brightest light of a full moon is never equal in intensity or quality to that which is reflected towards us by a white cloud on a summer day, it can scarcely be pretended that the weather is affected by such a cause. That the moon does exert attraction on us is manifest—we can see it working in the tides; but though it can move water it is most unlikely that it can do the same to air, for the specific gravity of the atmosphere is so small that there is nothing to be attracted. Laplace calculated that the joint attraction of the sun and moon together could not stir the atmosphere at a quicker rate than five miles a day. As for lunar emanations, not a sign of them has ever been discovered. The idea of an influence being produced by the moon is, therefore, based on no recognizable cause whatever. Furthermore, it is now distinctly shown that no variations in weather at all really occur at the moment of the changes of quarter, any more than at ordinary times. Since the establishment of meteorological stations all over the earth, it has been proved by millions of observations that there is no simultaneousness whatever between the supposed cause and the supposed effect. The whole story is fancy and superstition, which has been handed to us uncontradicted, and which we have accepted as true because our forefathers believed it. The moon exercises no more influence than herrings do on the government of Switzerland.

The Largest Machine Belt.

The New York Belting and Packing Company have recently made a rubber belt, 331 feet long and 4 feet wide, weighing 2 tuns, for use in the New York Central and Hudson River Railroad Company's elevator at foot of 60th street, North river, in this city. The driving power to be carried by this belt is estimated at 500 horses. It is believed to be the largest belt ever made.

Wooden Spoons.

In a work describing the present condition of the domestic industries of Russia, M. Weschniakoff states that not less than thirty millions of wooden spoons are annually made in that country, the industry having its great center in the district of Semenow. Poplar, aspen, maple, and box are the woods used for this purpose, and the cost of the spoons varies from about $5 to $20 per thousand.

SWIMMING A HORSE.—On reaching deep water, the rider should relieve the horse of his weight, by sliding into the water beside the horse, grasping the mane near the withers with one hand, thus requiring the horse simply to tow the rider, the latter assisting him in this, by using his legs and free arm in the same way as in swimming. In crossing rivers with rapid currents, the rider should take the down stream side of the horse.

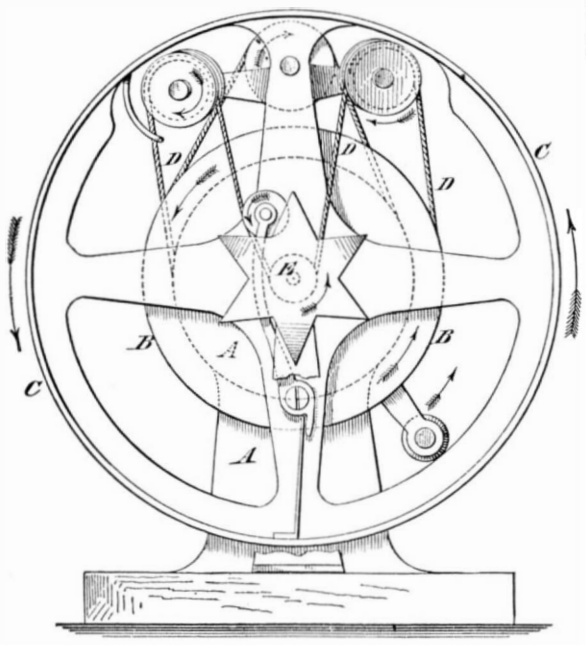
Manganese.

The important studies made of late years in chemical science have given manganese great importance in many arts and industries, and 50,000 tuns per annum are now imported into Great Britain, although a considerable quantity is raised from her own soil. It is used largely in the manufacture of bleaching salts (chloride of lime), in glass making, in the preparation of Condy's fluid (permanganate of potash), a disinfectant which, when mixed with water, sets free ozone in perceptible quantities; and in the manufacture of steel, it is rapidly becoming an ingredient of the highest importance.

The principal supply comes from Spain and Portugal, where it is found near the surface—seldom deeper than 90 feet. It generally occurs in pockets, and is of very uncertain occurrence, the miners proceeding generally by a kind of instinct rather than by any scientific rule. The ore is picked out from the pieces of rock with which it is mingled, washed, and sorted as to quality; then it is carried, generally in baskets on mules' backs, to the nearest railway or seaport. The miners, sorters, and washers are but poorly paid, even for Spain; and the discovery of manganese deposits in California, Virginia, and New Zealand is likely to limit the demand for this very useful metal in Spain and Portugal. Experiments are, however, being made in Belgium for the purpose of bringing it into use for making illuminating gas, for which it is likely to be extremely valuable.

A NEW GEARING.

There is now on exhibition at the Centennial Exposition,



in Machinery Hall, an exceedingly ingenious and novel mode of gearing, which will doubtless find many utilizations in cases where a high speed in revolutions is required, but where any extended system of cog wheels or other multiplying gear is neither desirable nor economical. The invention is illustrated herewith, and we purposely omit the call culations relating to the speed transmitted in order that the reader may solve for himself the neat mechanical problem which the device affords.

The construction is as follows: A is the standard; B is a grooved pulley rotated in the direction of the arrows by the crank, the end of the handle of which is shown below and to the right. C is a large balance wheel, loose on the shaft of B. D is a grooved stationary pulley formed on or attached to the standard; and E (dotted lines) is a small pulley outside the balance wheel, but attached to the end of an auxiliary shaft which supports the star-shaped piece, which may be a saw or other implement which it is desired to revolve rapidly. The order of mechanism on the line of the central shaft is, first, the crank handle; second, the standard; third, stationary pulley; fourth, driving pulley; fifth, loose balance wheel; sixth, and on auxiliary shaft, small pulley; seventh, standard; eighth, driven pulley.

On the balance wheel and near the rim are secured three small pulleys as shown. There is also a tightening pulley attached to said wheel by an arm near the center. The belt or chain is then rove as follows: Beginning on the driving pulley, B, then over the first small pulley of the three on the balance wheel, then down and over the small central pulley, E, then up and over the third pulley on the balance wheel, down and around the stationary pulley, back up to the middle pulley on the balance wheel, down around the driving pulley to the place of beginning, the belt being endless. The proportion between the driver and driven pulley is as 1 to 12; that is, the former in one revolution would produce twelve turns of the latter if simply belted or geared thereto; but by this device one revolution of the crank handle determines eighty-four revolutions of the driver pulley, so that the gearing augments the speed just sevenfold, without requiring any more room than would be occupied by the simplest mechanism. Theoretically, and friction neglected, there is apparently no limit to the number of revolutions which might be produced by properly proportioning the different pulleys. Of course the device can be used with gearing in lieu of belting. How the combination produces the sevenfold augmentation, and what must be the proportions of pulleys leading thereto, we leave our readers to puzzle over. The specimen at the Centennial is located at C 8, pillars 62 and 63. The inventor is Mr. Jonas Hinkley, of Norwalk, Ohio.

SUCCESS OF THE HELL GATE EXPLOSION.

The great mine at Hell Gate has been exploded. Soundings over the reef are not yet finished as we go to press, so that the present depth of water cannot definitely be stated; but judging from the extent of the visible result of the blast and from the fact that a large Sound steamer has already passed fifty feet nearer the shore than ever before, it is probable that the work is a grand success. Despite the assurances of General Newton, the effects of the concussion of the 52,000 lbs. of explosives were greatly feared, and for miles around windows and doors were thrown open, while people abandoned the houses near the mine. At precisely 2.51 P. M., the finger of General Newton's little daughter pressed the key, and the current exploded a torpedo which in turn broke the sustaining cord of a heavy pin-studded plate. As this fell, battery connection with the mine was established. Then a hundred vast fountains leaped into the air at once. Above these pure white columns, perhaps sixty feet in hight, shot a mass of dense black smoke mingled with flying mud and timbers. The explosion lasted three seconds. The concussion was very slight, but was perceptible at Springfield, Mass. Throughout New York city a dull rumble and muffled boom were noticed but no shaking of the earth was remarked.

We can add our hearty congratulations to those which General Newton is receiving from all quarters. The credit of the plan, however, belongs to A. W. Von Schmidt, who destroyed Blossom Rock, San Francisco. After the U.S. engineers had exhausted their resources in devising means to remove this formidable obstruction, Mr. Von Schmidt proposed substantially the same system of coffer dam and tunnels employed at Hell Gate; and he staked his fortune on success, for he asked no pay until the dangerous reef had given place to 24 feet of water. On the 23d of April, 1870, the 43,000 lbs. of gunpowder packed in the submerged tunnels and headings was fired, and Blossom Rock ceased to exist. The country is indebted to Mr. Von Schmidt's genius for the magnificent results obtained both at San Francisco and Hell Gate: to General Newton, for the engineering skill with which seven years of continuous and most arduous labor have been brought to a grand and befitting end.

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MEDIÆVAL IRONWORK.

The accompanying engraving shows a beautiful specimen of the renowned wrought ironwork of the middle ages. It is a lattice or grille for a window, and is a graceful and elaborate piece of work, wrought out entirely with the hand hammer. It is of German workmanship, and is to be seen at Botzen, a city of the Tyrol, one of those ancient cities to whose workmen we moderns are indebted for countless examples of what skill and taste can do in making our homes, churches, and streets beautiful, and the influence of whose works is now to be found in all parts of the earth.

A MEDIÆVAL WINDOW GRILLE.

Improved Hospital Construction.

We are indebted to Mr. John R. Niernsée, a well known architect of Baltimore, Md., for copies of sketches of various descriptions of wards suggested by him for the John Hopkins Hospital, in the above named city; also for a copy of his own review of the various complete plans submitted for the construction of that institution. In the sketches, the adjuncts of the wards are isolated from the latter by placing a connecting closed corridor between them in the basement only. The isolating vestibule connecting the buildings on the main floor has ventilation of its own, thus preventing any contaminating intermixture of air currents. By this system the architect proposes to obtain virtually all the advantages of the detached pavilion system of the lately completed great hospital in the city of Berlin, Prussia. The drawings exhibit five differently shaped common wards, with diverse arrangements of their adjuncts or service buildings, but all based on the principle of effectual isolation of the common ward.

The New Thames Tunnel.

The new subway between North and South Woolwich, which was lately commenced in London, is estimated to cost $375,000, and will consist of an iron tube in segments 9 feet high, with a breadth sufficient for four adults to walk abreast. It will be lined with white glazed pantiles and be lighted with gas, and will possess an efficient system of ventilation. The entrance at the south side of the Thames will adjoin the North Woolwich station of the Great Eastern Railway, and on the north side will adjoin the Woolwich pier. The charge to casual passengers will be two cents each way, but to workmen going to and fro books of tickets will be issued at a considerably reduced rate. The new tunnel is being constructed chiefly for the accommodation of the workmen engaged at the St. Katherine's Dock Extension Works, where 3,000 men will be employed for three or four years to come, the Beckton Gas Works, where 2,000 stokers are at work, Henley's telegraph works, Silver's india rubber works, Foster's wine stores, etc., numbering altogether some 8,000 men, who at present have little or no house or food accommodation within easy access of their work, North Woolwich being a dismal swamp unsuited for residential purposes. The new docks, which will materially increase the dock accommodation of the Port of London, will reclaim twenty acres of marsh land, and convert North Woolwich into a comparatively healthy island.

Liquid for High Temperatures.

It is often necessary to surround the pipes of heating or evaporation apparatus, and hot air apparatus, ovens, stoves, etc., with a boiling liquid at a temperature above 212° Fah.; it is also necessary to make use of water baths producing high temperatures. The liquid employed for this purpose is simply water in which sea salt has been dissolved. Oil baths, etc., are also used. Messrs. Grimm and Corvin propose, instead of these various agents, to make a solution of chloride of lime in glycerin, a solution which does not boil below 572 or 626° Fah., and has the further advantages of never attacking metals nor congealing.

Manufacture of Clouds.

The stage of Wagner's theater, at Bayreuth, required 3,247 gas jets. The rising mists and gathering clouds needed for scenic effects were produced by two large engines placed at a short distance from the theater, whose steam was carried by pipes to reservoir, from which it could be distributed by a network of tubes over the whole stage. In the corner towers of the theater are two cisterns, each holding about 1,200 gallons, from which water can be obtained at a very high pressure in case of need. The gas and water works of the theater have cost $30,000.

Ozone an Active Poison.

The eminent French chemist P. Thénard writes as follows in regard to the effect of ozone, or active oxygen, on the animal system. "I believe," says he, "that it is high time that the attention of the public, and even of the learned, was directed to the widely spread errors in regard to the action of ozone on the system. Far from being a remedy, it is rather one of the most energetic poisons that has been prepared in our laboratories, and the serious accidents which have occurred in my own leave no doubt of it. I will not enlarge on its physiological action, since A. Thenard will soon publish an article on that subject; but will only give prominence to the fact that, under the influence of ozone, even when greatly diluted, the blood corpuscles rapidly contract and change their form, the pulse become slower, so much so that a guinea pig with a normal pulse of 148, after being kept 15 minutes in a weak ozone atmosphere, had the pulse reduced to one thirtieth. At the present time, when an accurate method of measuring temperature is of great assistance in medicine, ozone may possibly prove a means of preventing too great a rise of temperature; but inconsiderately to disseminate ozone in inhabited places, in the delusive hope destroying a miasma, would be very dangerous. If our strongest poisons furnish in certain cases our best remedies, we must first learn how to use them, so as not to make a mistake in the time of giving or in the dose. Then, is it certain that ozone does exist in the atmosphere? Its presence there is proven by means of colored paper, the color of which changes more less in contact with the air. But who knows that there is not some other substance present in atmospheric air, which can modify this paper in the same manner as ozone? Wittmann passed a stream of air through the flame of a glassblower's lamp, and obtained a kind of air which acted upon the so-called ozonometric paper (starch and iodide of potassium) just as ozone does; but while this air disinfected badly smelling water without making it acid, ozone does not disinfect and does make it acid. Moreover, it is well known that ozone cannot exist at a temperature of 392° Fah. (200° C.), while this modified air of Wittmann's was exposed to a temperature at which glass softens."

It will be seen that there is still much to be desired in the discussion of this question, although it would be considered over-hasty to deny the possible presence of ozone in the air, or to assert that it is never used with profit in medicine.

AN ORNITHOLOGICAL ORNAMENT.

There is one distinction which the student of the superb exhibits of China and Japan, at the Centennial Exposition, finds himself called upon to make on comparing the respective displays. And that is that: while the Japanese impress us by their remarkable progress, by the wonderful celerity with which they are adapting themselves to Western ideas, habits, and customs, and with the admirable neatness and artistic beauty of their handiwork: still one may look in vain for the evidences of that tireless patience which, reinforced by skill transmitted from father to son for ages, results in the production of the marvelous work in ivory, in wood, and in porcelain, which abounds in the Chinese department. The Japanese bronzes exhibit the perfection of delicate labor; the Chinese carved wood ornaments show the same characteristic, but in addition indicate labor carried on over very long periods of time. The essential feature of everything Japanese is ingenuity and skill; of everything Chinese, patience; and nowhere throughout the Chinese exhibit is this last characteristic more prominently displayed than in the case of ivory goods in which the curious ornament represented in the annexed engraving is found.

In this case are the famous Chinese balls—hollow sphere after sphere being carved one within the other out of a solid lump of ivory, and yet each sphere is exquisitely carved and ornamented. Here also are superb sets of ivory chessmen, valued at over four hundred dollars per set; models of Chinese junks with every portion a marvel of delicate filagree work; fans reminding one of petrified lace and grotesque statuettes in ivory, in forms such as only originate in the Celestial mind. The ornament we illustrate is a large bird's head, the bill being made out of ivory, richly carved in groups of men, houses, and trees on its upper side. At this point also the bill is stained or rather clouded a deep red. The head proper is covered with feathers attached in some incomprehensible way, but so naturally that one would suppose, did so gorgeous a bird—not to mention a creature with an ivory beak—ever exist, that they grew there. The feathers above are of a deep peacock green; as the eye is approached, an exquisite shade of light blue is contrasted with a golden yellow, and a few light crimson feathers stand prominently forth from those of softer hue. Beneath the bill the feathers are of a rich brown flecked with black. The combination is one of surpassing beauty. The head rests on a base of ebony carved in intricate designs, and this in turn on an ornamental pedestal.

Flax Manufacture in America.

The commencement of a new manufacturing industry in this country is exemplified in the successful establishment of a small linen factory at Manchester, N. H. Some enterprising parties secured some land, sowed it to flax, gathered the crop, and prepared it for spinning, hired a Scotch flax finisher, procured spinning machinery and one loom, and worked up the flax carefully and slowly, until by easy steps the business was thoroughly understood and mastered. The amount of money risked was small, and in case of failure the loss would have been trifling. But it is precisely such ventures as this, and so conducted, that succeed, and this experiment has become a success. A linen manufactory is about to be put into operation with a certainty of its being practicable and profitable. It was in this way that the cotton manufacture began in the Southern States, where it is now a grand success. Woolen manufacture began similarly in the West, where it is now firmly established, and we are well convinced that it needs only to be begun in this careful manner for flax manufacture to become also an established business in the West.—*Bulletin of the American Iron and Steel Industry.*

Jacquard, the Inventor of the Figure Loom.

The Italian proverb, *chi dura, vinc,* is so true that the world has often had to lament the interruption of useful labors by the too early death of those who have begun them; the projector fails, and his half-executed projects fall back into formlessness. Jacquard, tried by fortune with a severity exceptional in the history of inventors, did at least last long enough to perfect his invention and know its success. The story of his life and an historical account of his world-famous loom are contained in a handsome quarto from the pen of Dr. Kohl, lately published.

Born at Lyons in 1752, the son of a journeyman silk weaver, young Jacquard grew up without more formal education than the reading he snatched as an apprentice in a bookbinder's shop. His energetic spirit was but disciplined by his difficulties; yet to have been able to have a share in advantages, now at hand's reach of every mechanic, would have been of priceless benefit to him, and, probably enough, of advantage to ourselves, the heirs of his successes. His mother died while he was yet young; when he was twenty his father died, bequeathing him a little house and a hand loom. Jacquard quitted his bookbinding for the loom, seeing the time come to carry out his improvements in it, which he had long been revolving. He married a woman who endured many years of privation with him; their first born was not many months old before poverty came upon him; he sold his little patrimony; and destitute, with wife and child, faced about to fortune, fighting necessity with a quick brain. Inventing, contriving, improving, he fought his way on till the thirty-seventh year of his age, when the revolution broke out.

He now became a soldier in the non-figurative sense of

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the word, and remained in the army till 1795, when his son, a lad of sixteen, was shot down at his side. In 1796 he came back to Lyons: the shade deeper in his large, melancholy eyes, his face graven by thought and sorrow into the sad patience shown so well in his portrait. He now devoted himself to the making practicable his figure loom, hoping thereby to reduce the tediousness of the work of the children employed in the weaving shops. He received sufficient support to enable him to realize his plans, and in 1801 exhibited at Paris his inventions, which won for him a bronze medal, and were immediately taken up by the Lyons master weavers. In this, as in later inventions, Jacquard retained no right of profit.

The next sight we have of him is at Paris, where he had brought a model of a machine to compete for a prize offered for a mechanical method of making fish nets. Introduced to General Bonaparte and his adjutant Carnot, the latter roughly asked him "if he were the man who professed to do what God himself could not do?" The general came to the aid of Jacquard, and, with characteristic insight, approved both invention and inventor, dismissing the latter with encouragement to experiment further.

In 1804 the Society for the Encouragement of Industry became Jacquard's patron, and gave him a post in the *Conservatoire des Arts and Métiers*. This was perhaps the fairest part of the inventor's life, and invention after invention surprised the world with his fertility. It was in the few months that he kept his post here that he recreated Vaucanson's spinning loom. Unluckily for himself, he received and accepted an invitation from Lyons to superintend a factory there, and left Paris before he had been in it a twelve month. In 1806 the Prefect of Lyons received an imperial order to pay Jacquard a pension of $600 a year, on condition that the latter conceded to the city of Lyons all the right and profit in the use of his inventions, binding the inventor to watch over the same and give his whole time to them. The far-sighted and very capable Emperor acted exactly as many a rascally overseer in a factory does by a clever subordinate, who, at the cost of a little inexpensive distinction, is flattered out of the fruits of his brain. From this, the highest moment of his fortunes, began their decline. Public opinion in Lyons turned against him, his models were used without compensation, he engaged himself in contracts in which only his own side was kept to, his machine was slandered as a plagiarism of Vaucanson's. The weavers were accused of purposely spoiling their goods to bring the Jacquard loom into discredit; and their hatred to their benefactor, expressed in often repeated threats of murder, culminated in their breaking up and burning, in the Place Terraux, models and machinery together—scenes, the horrors of which flashed up again only too vividly when Jacquard was an old man and came to die. Only inventors and benefactors know the innermost bitterness of moments such as these.

Little by little the Jacquard loom came into universal use, and at length, in 1840, the Lyonnese, aided by foreign subscriptions, set up in honor of their great citizen a bronze statue, with the inscription:

A. JACQUARD
LA VILLE DE LYONS RECONNAISSANTE
MDCCCXL.

The inscription must have been written by a foreign satirist. Jacquard died on August 7, 1834, in the 83d year of his age.

The sketch which Dr. Kohl gives of the life of the inventor is followed by the fullest details of his inventions in the order of their development. An atlas of mechanical plates, beautifully executed, complete the very perfect monograph, to which a last interest is given by its German authorship.

Correspondence.

Rat-Tailed Larvæ.

To the Editor of the Scientific American:

I wish to call your attention to something I found recently at a neighbor's. The curiosity consists of larvæ, about ¾ inch in length and ⅛ inch in diameter, of cylindrical form, having usually six feet on each side, and covered by a transparent skin through which the internal viscera can be distinctly seen; but most remarkable of all, the posterior end of the body terminates in a caudal appendage of about the same length as the body, and presenting to the eye the same appearance as the tail of a mouse or rat.

One thing that attracted the attention, of the gentleman at whose place I found these specimens, was the fact that the water in which they were found had contained the carcasses of four or five drowned rats; and when they were thrown out of the barrel in which the water was contained, the bodies of two of the rats were filled with these rat-like worms! Upon the water, which was quite stagnant and foul, were several hundreds of these larvæ, some alive and squirming and crawling up the sides of the vessel, but a majority dead; but all had the tails.

I am not much of an entomologist, but have given the science some attention; and in all my reading, and in such search as I have been able to give the matter, I can find no authority for maggots with tails like rats, which these undoubtedly are. They are new to me, although they may be familiar to you. Will you please let me know where they belong? R. M.

Emporia, Kan.

[The curious "rat-tailed" maggots, so graphically described in the above letter, are the larvæ of a large two-winged fly belonging to the genus *eristatis*.

They may be found not only in stagnant pools, but also in water-soaked rotten wood, and are quite common in salt vats. Our correspondent may rest assured that, singular as was the resemblance which struck him so forcibly, between these larvæ and the rats that were found drowned in the same vessel with them, it was a mere coincidence and not in any sense a case of mimicry or inheritance. The larvæ of *eristatis* being aquatic or amphibious, the tail-like appendage is in reality a respiratory tube, provided at the tip with two stigmata which may be protruded above the surface of the water for the purpose of inhaling air while the larva remains concealed beneath. These larvæ are further characterized by the seven pairs of well developed prolegs or leg-like tubercles: the young of no other species of *diptera* possessing so complete a set of locomotive organs. When ready to transform, they leave the water and burrow into the ground, changing to coarctate pupæ, of which the tail still forms a conspicuous part. The flies are frequently seen hovering about flowers in the spring or buzzing loudly against our windows in autumn. One species has large, bright copper-colored eyes, and a stout body of metallic green color, the thorax ornamented with five gray stripes. Some are gaily banded with black and yellow, and, except by a careful observer, might be mistaken for wasps. Others again have hairy bodies and legs, and more nearly resemble bees.—EDS.]

Expansion of Locomotive Boilers.

To the Editor of the Scientific American:

I notice that some builders of locomotives still persist in fixing the side bars or framing of their engines rigidly to the boiler, notwithstanding their knowledge of the expansive qualities of metals. Under ordinary changes of the weather, all iron structures of much extent, if designed for durability, must have provision for easy play of this resistless and ceaseless action caused by change of temperature. How much more important is it that careful provision should be made for the free expansion and contraction of a locomotive boiler, subject as it is to vastly greater changes of temperature!

It has been found by experiment that the quality and condition of a metal determines the percentage of its expansion. For instance, tempered steel expands more than untempered, and soft forged iron more than common commercial bars. The expansion varies slightly also with different qualities of the same metal, so that there can be no fixed formula by which to predetermine the exact amount of this change by temperature.

It may be stated generally that zinc will expand 0·0029, lead, 0·0028, tin, 0·0028, copper, 0·0019, silver, 0·0019, brass, 0·0019, gold, 0·0015, wrought iron, 0·0012, steel and cast iron, 0·0011, of its length by the addition of about 175° to its normal temperature. In other words, a rod of zinc 25 feet long will lengthen ⅞ of an inch, lead and tin $1\frac{3}{16}$ inch, copper, silver, and brass ⅝ inch, gold and wrought iron $\frac{7}{16}$ inch, steel and cast iron ⅜ inch.

It will be noticed that copper and brass vary much more than wrought iron: hence the unfitness of these metals for any part of an iron boiler, either for tube sheets or tubes. The expansion of steel being somewhat less than that of wrought iron, it would doubtless be good practice to use steel both for fire boxes and tubes in iron shells, on account of the more direct and intense heat in contact with these parts, which would compensate for the less expansive quality of steel.

One of the present long locomotive boilers, under the high pressure at which they are worked, will expand from five to seven sixteenths of an inch probably, depending somewhat upon the age of a boiler, and the quality and condition of the iron. Who can estimate the great strain thus imposed, and its effect upon the boiler and machinery when the side bars are rigidly fixed to the boiler? We only know that the boiler soon becomes leaky, and that the machinery does not retain that perfect linage in which it was first placed by the painstaking machinist, and which is so essential to the durability and economy of an engine.

It is true that most locomotive makers provide partially for the expansion of the boiler by elongating the screw holes in the feet of the brackets and braces that rest upon the side bars, and more recently by loops which embrace the side bars along the sides of the fire box; but there are some builders who still persist in fixing a central girder rigidly both to the boiler and side bars. I refer to the girder which sustains the rear end of the crosshead guides. I am partial to the looping principle, and this central girder and the feet of all braces attaching the side bars to boilers should simply embrace the side bars in the form of a loop nicely fitting the side bar; and the rear ends of the crosshead guides should slip into the central girder so as to allow of a slight lengthwise play.

But the saddle casting, to which the cylinders are attached, should of course be most rigidly and thoroughly fixed both to the boiler and side bars. Then the office of all the other fastenings which hold the side bars to the boiler would be simply to keep the guides and machinery in perfect line without obstructing in the least the free lengthwise play of the boiler. It is excellent practice to cast half of the saddle with each cylinder, and then bore and fit the cylinders together, so that they lay perfectly parallel with each other, of course both vertically and laterally, and then fit them to the boiler as a single casting. In getting up a pattern of this kind, the pattern maker should be familiar with some of the intricacies of molding; if he be not, he should consult an intelligent molder.

Worcester, Mass. F. G. WOODWARD.

MR. MERRICK BEMIS' address is New London, Conn., not New Haven, Conn., as stated on page 177, current volume.

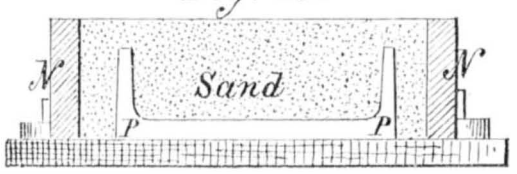
PRACTICAL MECHANISM.

BY JOSHUA ROSE.

SECOND SERIES—Number XI.

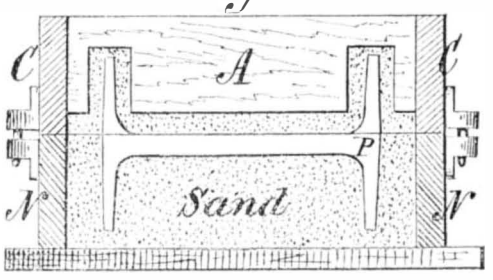
In Figs. 76 and 77, we have another example of flask molding, but for a pattern of different shape to our previous

Fig. 76.



one. The pattern is, in this case, not made in halves, its flanges on one side being left loose. In Fig. 76, one half of the pattern is shown on the molding board, and the nowel placed thereon and rammed with sand; while in Fig. 77 the

Fig. 77.

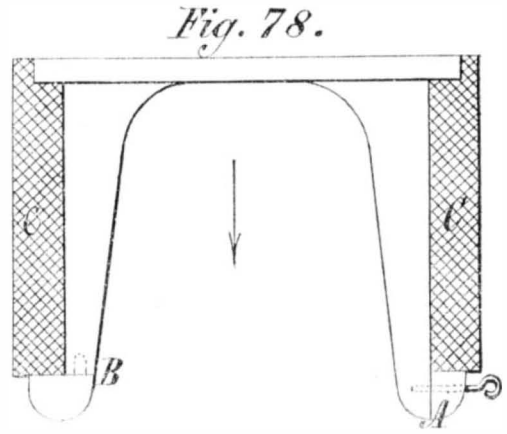


pattern is shown molded and ready to have the cope taken off, A representing one of the crossbars fitted into the cope and following the outline of the pattern.

CORES

are projecting bodies of sand, either left in the mold by the pattern itself or else made in a separate device called a core box. They are placed, after being dried, in position in the mold. The purpose of a core of the latter description is to leave a hole or recess of such a peculiar shape or in such a position that it is impracticable to make the mold of the necessary conformation by the use of the pattern alone. The use of these cores also permits us to modify the shape of a pattern that would otherwise be difficult to mold. For example, Fig. 78 represents a plate of such length that it is necessary to mold it in the direction indicated by the arrow; as the pendants, which are long and narrow, with their

Fig. 78.



projections at the extremities, would lock the pattern in the mold. Three methods present themselves whereby to overcome the difficulty. First, we may make the projection loose, the vertical line, A, being the joint; and it is held in position by vertical dovetails or by horizontal wires, as shown in Fig. 78. In the latter case, the molder, when ramming the sand, withdraws the wires; and when the pattern is withdrawn from the mold, the two different projecting pieces are left in the mold, and are subsequently retracted horizontally, and then lifted out. It is obvious that this can only be done when there is sufficient space to accommodate the projecting piece as it is withdrawn from its recess in the sand, and to admit of its being raised to the surface. To this method there is the objection that the recess left by the projecting piece in the mold cannot be, in many cases, either inspected or dressed if any reparation is required. A second plan would be to make the projecting piece join the pattern at the horizontal line, B, in Fig. 78, but separable from it; but in this case a three-part flask would have to be used, entailing double work for the molder. The third method is to affix the core prints, C C, to the sides of the pattern, leaving those sides smooth and even; and the pattern will then draw easily out of the mold. If we then core away all we have added to the pattern, as shown by the dotted lines in Fig. 78, the casting will retain the correct shape of the pattern. To effect this coring away, we make dry sand cores of the shape of the core prints, C C, and place them in the mold. Ordinary dry sand cores are composed of a mixture of sand and flour moistened with water, and they are molded to the requisite shape in the core boxes already mentioned. They are then baked, becoming sufficiently strong to handle; but previous to the baking they are so weak that they cannot be handled without being in some way supported. It is, therefore, as great a consideration to the pattern maker how the core is to be taken from the box as it is how a pattern shall be drawn from the mold. We may divide cores molded in a core box into three classes: First, those that lie as they are made; second, those that require turning over; and third, those that not only require

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turning over, but require also a bed of sand made for them to lie upon during the process of baking. Figs. 72, 73, and

Fig. 73.

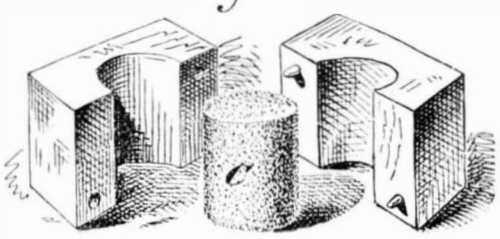


Fig. 72.

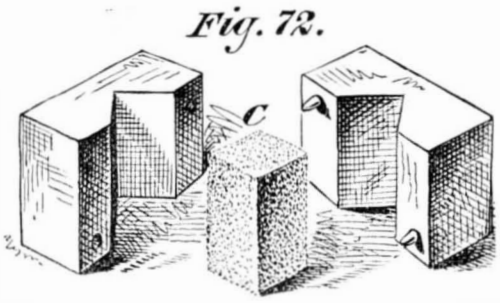
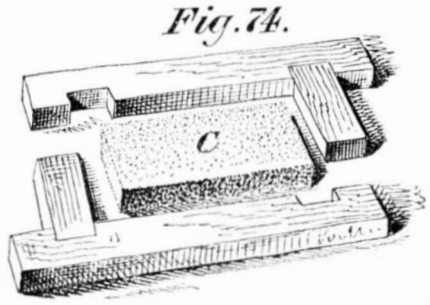
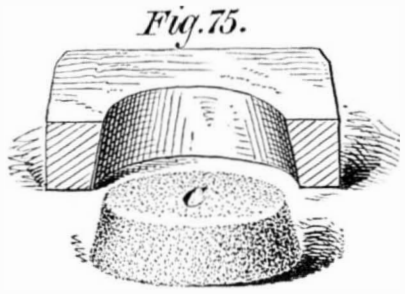


Fig. 74.



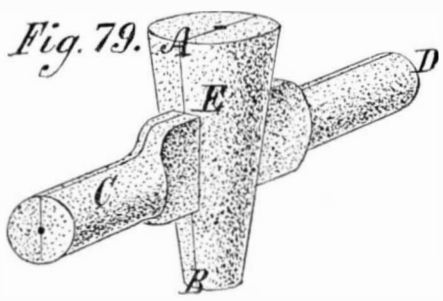
74 are examples of the first, in which the cores are represented by C. The core boxes, being made in halves and loose at two of the opposite corners, can be drawn away from the cores, C, leaving them standing, just as they were made, on an iron plate ready for removal to the oven. In a core box made as in Fig. 74, it is necessary to bore in the ends a couple of small holes for the insertion of wires to effect ventilation. In cases where sufficient draft or taper can be allowed on the core, the core box need not be made in halves, but may be made solid, as shown in section in Fig. 75.

Fig. 75.



While it is the aim of the pattern maker to form his core boxes to work in the simple manner illustrated in our examples, there are very large classes of cores with which such easy methods are impracticable. This, for instance, is the case with all round cores that are of such length that they are not able to support themselves on end, and with those having branches, as shown in Fig. 79, which represents a core for

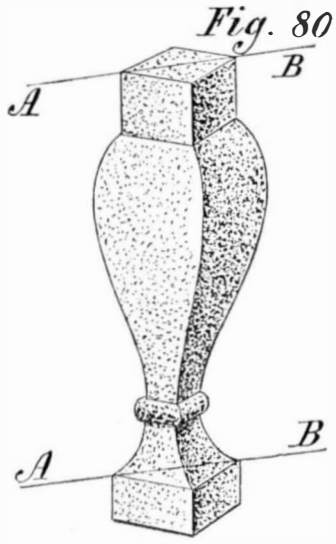
Fig. 79.



a straight faucet. If it were attempted to make this core in a vertical position, its overhanging branches would fall away immediately after separating the two halves of the box; hence it is made horizontally, and generally in separate halves, which, after being baked, are pasted together and again dried, thus forming the full round core. In cases, however, where great numbers of such cores are required, as in steam fitters' work, they are usually lifted from the box whole; but it is a delicate operation, involving much practice. We need not, however, go into this, the subject only being mentioned to show how a pattern maker decides whether he shall make a full core box or only half a one; for if the halves of the core are to be made separate, and one part is exactly similar to the other, then a half core box is all that is necessary. Suppose, for instance, the core of a faucet, shown in Fig. 79, to be alike at the branches, C and D; then, it being made in two halves meeting in a point represented by the line, A B, the core box may be made to mold the half, E; and two of such halves, pasted together as described, will form the whole core. In this particular example, however, there is yet another way of making the core, providing the branches, C and D, are parallel in diamter, and that is to punch holes in the main part of the core, through holes provided in the core box, using a piece of wood for the purpose.

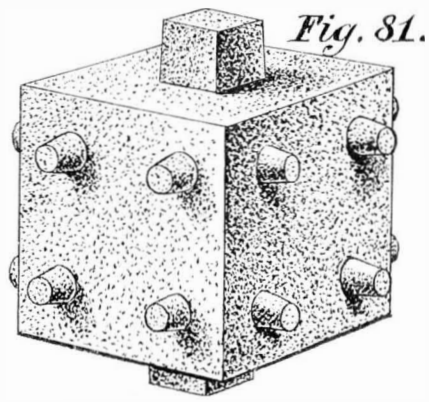
Fig. 80 is an illustration of a square core for a baluster; its four sides being curved, it is necessary to make it in separate halves, dividing it diagonally across the corners, as denoted by the lines, A B.

Fig. 80.



We have now to give an example of the third class of core, which will not stand on end and does not present a flat surface on any of its four sides, neither can it be readily divided, as in the former case. Fig. 81 is an illustration of

Fig. 81.



probably the simplest kind of this class, which will require a core box that must part in all directions in order to enable us to extract the core, which will require, in addition to this, what is called a turnover box. Fig. 82 is an end sectional view of this core box, having four jointed sides and a bottom, with holes cut in them where the projections are to be formed on the core. The top, in this case, is simply two bars that cross the box where the projections occur; and holes are cut in these bars to form the projections. The box is retained together and kept in position by the taper pegs shown at the junction of the sides. The ends of the box are recessed to receive the sides, but all is removable. In using this box, after ramming up the top, the crossbars are removed and in their place is mounted the turnover box,

Fig. 82.

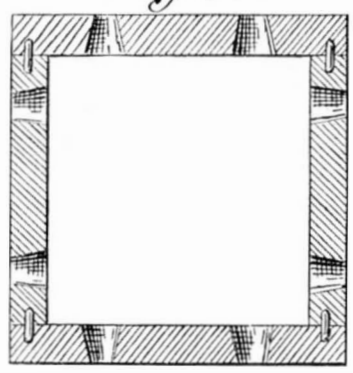
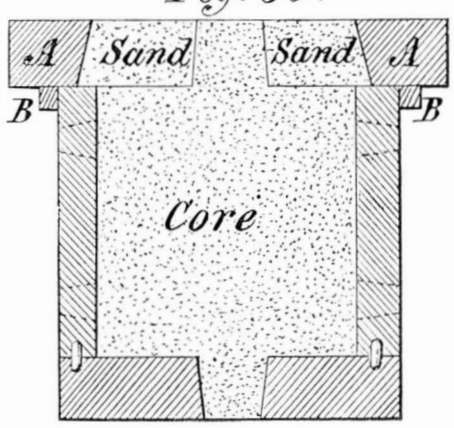


Fig. 83.



shown in section in Fig. 83, at A, which is a simple square frame, made taper. It rests on the outer edge of the core box, so as to give a bed of sand somewhat larger than the core itself. Small blocks nailed to the underside, B B, keep it in position. The frame is then carefully filled with ordinary molding sand, so as not to disturb the projecting parts of the core, and the sand on the outside is then struck off level. An iron plate is then placed on the top of all, and the whole is turned upside down. The bottom of the core box, which has now become the top, is first removed, and then the sides and ends. Thus the turnover box affords a bedding of sand, on which the core may rest without suffering injury from its own weight.

It would be a costly matter to make core boxes for long cylindrical cores, such as are used for pipe and similar castings; hence, for such purposes, a core is made as shown in Fig. 84, in which C represents a core for a pipe, having a socket at one end. It is prepared as follows: Upon the two tressels, A A, is mounted the long tube, D D, which is perforated throughout its entire length with numerous small holes, and which is provided at one end with a crank handle, by means of which it may be revolved as it rests in the two rude V bearings, provided in the top of the tressels, as shown. Upon this tube a layer of rudely twisted straw rope, sufficient to make its diameter assume, from end to end, nearly the required diameter of the core, is coiled. Outside the straw rope, there is then applied a coating composed of a mixture of loam and other material, sufficient to increase the diameter from end to end, somewhat above the finished size. To round up the core even, and make it of the necessary size, the core or loam board, B B, is employed. It is simply a board ranging in thickness from seven eighths inch upwards, according to its length. One of the edges is cut to the conformation of the required core; and all but about three sixteenths of an inch of the thickness of this edge is beveled off at an angle of about 30°. This board is laid upon the tressels with the beveled edge uppermost, and is held in position by weights placed upon it over the tressels. The core is then revolved by the handle in the direc-

Fig. 84.

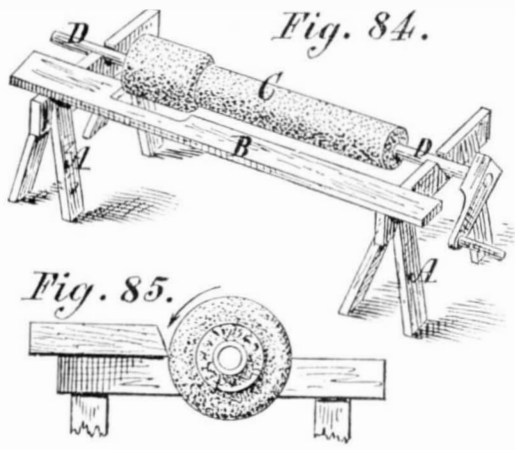


Fig. 85.

tion of the arrow, as shown in Fig. 85, in which A represents the tube, B the straw rope, C the loam coating, and D the board. It follows that, as the loam is added, the board will level it off, leaving the surface round and true, and to whatever shape the edge of the board may be made. It is customary to mix, with the coating of loam, horse dung or a substitute therefor, the object of which is as follows: It will be readily perceived that it is a difficult matter in a long casting to give vent to and permit the escape of the air and the gases formed in the mold by the molten metal; but by mixing in with the loam a combustible material, the latter becomes consumed during the baking of the core, leaving the latter porous, so that the air and gases can pass from the mold through the loam coating and thence through the straw rope, and find exit through the hollow tube upon which the latter is wound. We are now, however, verging upon the work of the loam molder, a subject of great importance to the pattern maker, and which will therefore demand some extended observations after the simpler examples of pattern work have been explained.

Naval Items.

The United States steamer Vandalia was subjected on September 8, on the eve of her departure for the European station, to a speed trial over a carefully measured course of three nautical miles in the Hudson river, under the superintendence of a special board of naval officers. She made four runs, two up and two down, over this course. She was fully armed and equipped for a cruise, laden down to her deepest draft. The following are the results of the trial, which was pronounced highly satisfactory, as well in regard to the working of the machinery as to the developed power and speed:

Draft of vessel during trial: Forward, 16 feet 10 inches; midships, 17 feet 3 inches; aft, 17 feet 8 inches. Area of midship section at that draft, 516·6 square feet; displacement of vessel at that draft 2,130 tuns; average steam pressure during trial, 76·3 lbs.; indicated horsepower developed, 1,176; average speed of four runs, 12·06 knots per hour; force of wind, 1; water, smooth; tide, last of flood, slack water, and first of ebb.

The Vandalia is a new sloop of war built at the Boston navy yard, and has a pair of compound engines designed at the Bureau of Steam Engineering of the Navy Department. She was completed and put in commission in the early part of the spring of this year, and has since done service at different parts of our coast. The following are the principal dimensions of the vessel and of her machinery:

Length of vessel on load line, 219 feet; extreme breadth, 39 feet; diameter of cylinders, 42 and 64 inches respectively; stroke of pistons, 42 inches; area of grate surface, 240 feet. She has a four-bladed screw, of 15 feet 6 inches diameter and of 21 feet pitch.

The above trial differed in some essential particulars from the "measured mile trial" of English naval vessels. Their dash over the short course of a single mile is made under exceptionally favorable circumstances, namely with a special force of carefully trained firemen, the best picked coal, and not unfrequently a forced draft: the object of the trial being a test whether the different parts of the machinery are properly proportioned to one another and to the hull. It is evident that the trial of the Vandalia, made under the conditions of ordinary service and over a three times longer course, affords a much closer estimate of the actual capabilities of her machinery.

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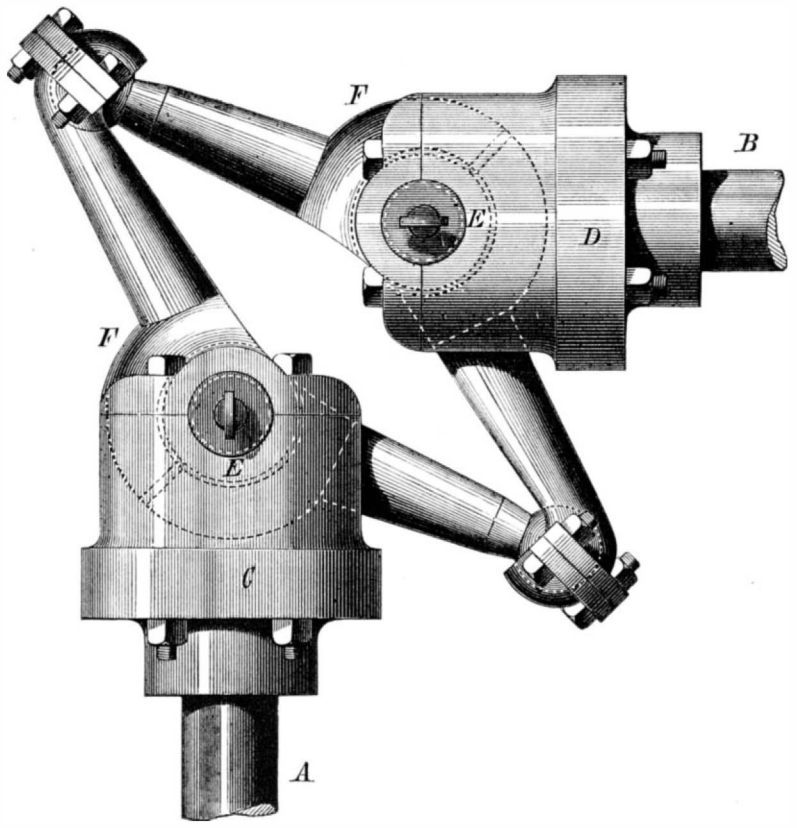
A NEW MECHANICAL MOVEMENT.

The annexed engraving illustrates a new mechanical movement for transmitting rotary motion, in substitution of bevel gears, the invention of Mr. Melville Clemens, now of Philadelphia, Pa. The apparatus is so constructed that absolutely the same angular velocity of the driving shaft is transmitted to the driven shaft, with positive exactness and avoidance of back lash; and the joint makes a self-adjusting, flexible coupler, enabling the placing of the connected shafts at all desired angles of deflection, from a straight line up to and beyond a right angle.

Compared with bevel gears, especially for heavy work, the present device offers the advantages of being noiseless and of possessing greater strength, durability, and safety, besides its complete range of shaft divergence.

The engraving shows sections of two shafts, A and B, connected at right angles by the coupler; on said shafts are fixed, concentrically with their axes, the like cylindrical heads, C and D, each of which are slotted transversely, forming like jaws, on which journal caps are attached by bolts. Journal bearings are formed through the jaws, at right angles to and concentric with the axis lines of their respective shafts, in which journals are fitted like journal pins, E. The four equal coupler arms are carried in pairs in the jaws, by their hinge-jointed hubs, on the pivot pins, E. The outer ends of the arms are coupled together by two like ball-and-socket joints, each joint being formed by a ball turned up on one arm and fitting a take-up socket box, formed on its connecting arm and Babbitted. The weights, F, on the arm hubs, preserve the balance and uniform momentum of the two pairs of rotating and vibrating arms. The pivot pins are cored out for oil reservoirs, from which oil is supplied, through holes plugged with leather, both to the journal bearings and to the ball joints, making the apparatus self-lubricating. Motive power being applied to rotate either shaft, the inner ends of the arms will revolve with their respective shafts, while the outer ends of the arms will revolve in their diagonal circle of rotation, which compound rotary movements cause the arms to vibrate, both on their pivot pins and at their ball joints, with equal pivot movements: the arcs of vibration at each pivot being, in each revolution of the shafts, equal to the angle of deflection of the coupled shafts. The angular velocities of the two shafts are evidently the same at all points of a revolution of them, when we consider the arms of each opposite pair as equal levers in all their positions during a revolution.



CLEMENS' MECHANICAL MOVEMENT.

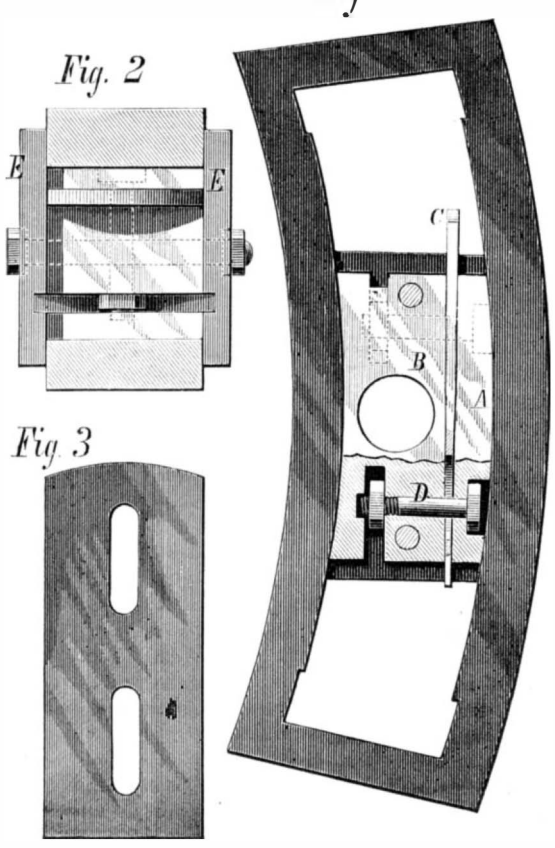
Mr. Clemens has secured patents in this country on his invention, bearing dates November 2, 1869, and April 23, 1872, and has also received patents in several foreign countries. One of his shaft couplers for one hundred horse power can be seen at section C 9, Machinery Hall, Centennial Exhibition, in connection with the exhibit of Mr. George V. Cresson, of the Philadelphia Shafting Works.

Parties desirous of ordering the shaft couplings for the Middle States and Ohio, address George V. Cresson. For orders and territorial rights for the Western and Southern States, address the inventor, Melville Clemens, care George V. Cresson, 18th and Hamilton streets, Philadelphia, Pa.

IMPROVED LINK BLOCK FOR LOCOMOTIVES.

We illustrate herewith an improved adjustable link block,

Fig. 1



claimed to fit tightly in the link and to wear it equally. It has other advantages, which will be found fully described below.

The block is not constructed in one solid piece, as is ordinarily the case, but is composed of two longitudinal parts, A and B, the adjoining sides of which are made with suitable inclination to receive the wedge piece shown at C, Fig. 1, and separately in Fig. 3. Screw bolts, D, connect both parts, the heads being countersunk in the recesses of one part while their threaded ends with screw nuts are adjusted by a wrench introduced into the slotted recesses of the other part. The wedge piece is suitably slotted to slide along the connecting bolts. Fig. 2 is a top view of the device, in which E E are the face plates which guide the blocks.

All who are familiar with the link, and its operation with the present style of solid block, know that it is the concussion of the block in the link that causes the link to wear so unevenly; that there is no effectual way of taking up the lost motion; that as soon as it occurs it accumulates very rapidly, causing unnecessary wear on the link and all connecting parts, and the engine to run at a great disadvantage. To remedy matters a large amount of work is required.

With the present improved link block, the inventor claims that one block, properly fitted, will wear the link perfectly true and outlast the engine, providing only the lost motion is taken up as soon as it is perceptible, and not left to accumulate as in the case of the solid block. That the valves can be set and kept square without losing lead. That when the lost motion is obviated, no appreciable wear can take place on the side plates, while much of the wear on rods, pins, etc., will be saved. That the lost motion can be taken up in a few moments without taking down or disturbing any other part of the machinery. That the necessity of using the piece link is avoided, and the solid case, hardened link, which is allowed to be far preferable, can be used to the greatest advantage, and that the device is not costly. The block can also be used as the ordinary old style block to advantage. When, after being used, the links need grinding out and new blocks fitted, all that is needed is to lap out the pin hole, insert a liner between the key and block, or fit in a thicker key, and a block equal to new is gained at a very trifling cost.

Patented through the Scientific American Patent Agency, June 23, 1874. For further information address the inventor, Mr. W. A. Alexander, P. O. box 130, Mobile, Ala.

Carbon Bisulphide as an Antiseptic.

Herr P. Zöller publishes the statement that, in an atmosphere containing a small quantity of the vapor of carbon bisulphide, animal and vegetable matters are effectually preserved against decomposition or putrefaction.

The author affirms that a few drops of this substance is sufficient for the purpose; and since it volatilizes at ordinary temperature, the employment of heat is rendered unnecessary. In this manner, he adds, bread, vegetables, fruit of every kind (and fruit juices), and meat may be preserved for a considerable time in closed vessels. Upon opening the vessels, the unpleasant odor of the bisulphide is very apparent; but upon airing the substances treated for a few minutes, it disappears entirely by volatilization. In the case of meats, the flesh, after having been submitted to the above treatment for several weeks, is in no wise unpleasantly affected.—*Deutsche Industrie Zeitung.*

American Meat in Europe.

The exportation of fresh meat in Europe seems destined to attain more importance than its promoters originally expected. It is but a little time since the steamship Abyssinia took the first shipment of fresh beef from New York—the dressed carcasses of 120 head of New York and Western cattle—contained in an iron refrigerator having an air exhausting apparatus. Now fresh meats form an important feature of all outgoing cargoes.

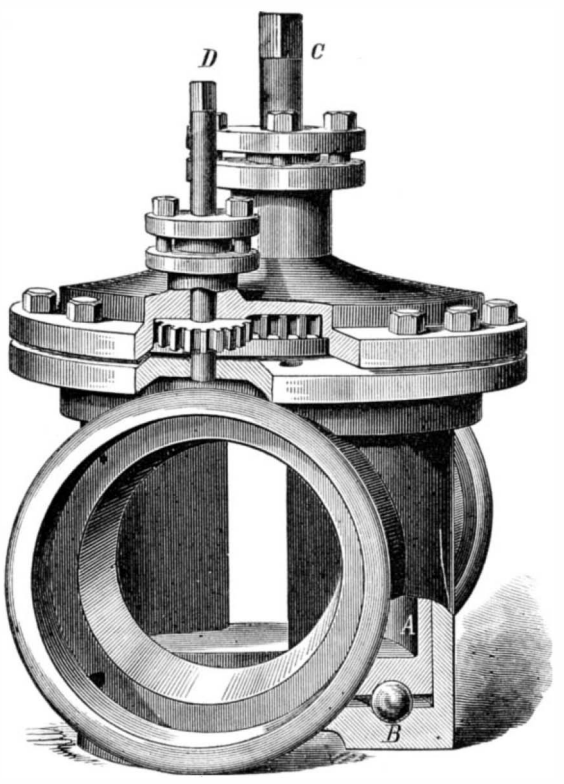
IMPROVED STOP VALVE.

The invention herewith illustrated is an ingenious and novel appliance designed as a substitute for the valves principally employed in water and gas mains. The common valves are usually mere diaphragms moved by a screw either inside or outside of the valve chamber. Outside screw valves are at present most employed; but owing to the length of the screw and its consequent long travel in order to open the valve, the latter is placed on its side. This avoids the deep excavation otherwise required, but still necessitates a long narrow vault, which must be bricked and otherwise finished, and the construction of which, in rocky ground such as is constantly found in many New York streets, we are informed, may cost, for a large valve together with the gearing necessary to work the valve, as high as a thousand dollars. The outside screw, moreover, is liable to rust, and therefore needs constant oiling and attention to keep it in working order. The inside screw, while not subject to the last mentioned difficulties, is easily bent and rendered inoperative; and in case of its fracture, the valve falls across the pipe, and is extricated only with considerable trouble and expense.

The present inventor, who has had a long practical experience in the laying of both water and gas pipes in this city, has devised the valve illustrated herewith on an entirely different principle, and he claims that it will altogether obviate all the disadvantages above noted. It consists of a cylinder, A, having an opening cut through it and placed in a valve chamber. By turning the cylinder on its vertical axis, either the aperture or the solid portion is carried in face of the pipe connections, and thus the water is allowed free passage through, or is shut off by, the valve. The cylinder rests below on rubber balls, B, so that its motion is always free on its seat, while its weight is thus firmly supported. Above, it is flanged so that no water can pass up over it into the bonnet. It has a central stem, C, to which the tool for turning it may be directly applied. In valves of large size, on the upper portion of the cylinder is a gear wheel, and in this meshes a pinion on an auxiliary shaft, D; so that by turning the latter the cylinder can, when desired, be rotated with less power than when operated directly by the central stem.

This valve, being practically but little larger in diameter than the pipe itself, requires no vault, and can be inserted anywhere. In places where pipes mingle, rise above, or cross each other, where it is generally impossible to work the ordinary screw valve, the apparatus shown in our engraving is inserted without difficulty. All its parts are covered so that they are not liable to stick; there is no screw to strip; the cylinder cannot fall, nor is there any portion to become out of order. We understand that the invention is already in successful use in many localities in this city It is applicable to all purposes.

Patented through the Scientific American Patent Agency,



August 29, 1876. For further particulars address the inventor, Mr. J. D. Keegan, 240 West 31st street, New York city.

Railroads in the United States.

Railroad building in this country is progressing with much more rapidity than in 1875. *The Railroad Gazette* for September 8 states that 1,388 miles of new railroad had been completed in 1876 up to that date, against 678 miles reported for the same period in 1875, 984 miles in 1874, 2,408 mile in 1873, and 4,264 miles in 1872. The Los Angelos Division of the Southern Pacific Railroad has been completed, and the Cincinnati Southern is now the only other long line in the country now under way. It will be completed in 1877

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VINES FOR WINTER DECORATION.

It may at present seem to be early to be preparing floral ornaments for indoor decorations; but six months beforehand is hardly too soon to commence setting out vines and cuttings for this purpose.

It is a matter of course, says the *American Garden*, from which we select the engraving published herewith, that pots should be used, and then the plants need not be disturbed in the fall. The best of soil, fine dark leaf mold from the woods, should be used; if it be mixed with sand, your plants are sure to thrive with ordinary care. If leaf mold cannot be obtained, use garden loam mixed with sand; but in this case water the plants freely with liquid manure. If started early, your vines will have made a good growth by autumn, and be ready with the best of their foliage and flowers when brought into the house. Be sure that they are not exposed to frost, for the slightest touch will check their growth, and make them miserable and sickly all winter.

In choosing plants suited for this purpose, select only those species which will succeed with ordinary accommodations and treatment. It is useless to spend time and strength on delicate plants that can only be brought to perfection with greenhouse heat and moisture.

Ipomea coccinea, which we illustrate, is a very rapid climber, of the same family as the morning glory, though much more delicate in flowers and foliage. It is excellently suited for window ornamentation, as it is a very rapid grower: it will usually begin to bloom in four to six weeks after planting the seed. The flowers are small and star-shaped, of a brilliant scarlet color, and produced in great profusion. Many who fail with almost everything else succeed in growing this plant.

IPOMEA COCCINEA.

Saw Flies.

Mr. F. Smith, in a recent paper before the London Entomological Society, says: "This *nematus gallicola* is one of the commonest species of saw fly found in Europe; it is the maker of the well-known red galls, so plentiful on leaves of different species of willow. The galls are, as Mr. Cameron observes in his communication to the *Scottish Naturalist*, somewhat local, but they are extremely abundant in many situations. I have on many occasions collected large quantities of leaves, more or less covered with galls, and have bred many hundreds of the flies—all proving on examination to be females. Mr. Cameron observes, in the paper alluded to: 'The male is quite unknown to me, and this appears to have been also the case with Hartig.' Last spring I collected, in the London district, a quantity of the galls, placing them in a large flower pot half filled with garden mold. The larvæ soon quitted the galls and buried themselves in the mold for the purpose of undergoing their transformations. About a month after this the flies began to issue forth, probably to the number of from five to six hundred; among this number I had the satisfaction of finding two males. This sex closely resembles the female, but has a narrower body, longer antennæ, and the tip of the abdomen is pale; the abdomen is also narrower, and not, as in the female, widened toward the apex. This season I have repeated my experiment, and have obtained a single male out of several hundreds of flies.

"Mr. Cameron further observes: 'In all probability they, like *cynips* (*lignicola*) *Kollari* and other *cynipidæ*, propagate without the aid of the male sex.' This observation was undoubtedly made in ignorance of the discovery made by Mr. Walsh in 1868. In the *American Naturalist* for that year, the author records the fact of having himself bred both sexes of *cynips spongifica* from the galls of the black oak of North America. These galls resemble those of *cynips Kollari*, being globular, rather larger than the European galls, but of the same hard woody consistence externally, and of the same spongy substance inside. Mr. Walsh adds: 'By the fore part or middle of June, both male and female gall flies eat their way out of a certain number, say about one fourth part; the remainder are not developed until about two months later.' In a private communication from Mr. Walsh, I learnt that he had, like myself, bred hundreds of the gall flies from galls collected late in the autumn, all these proving to be females, and that it was not until he made collections of galls in summer, when a partial development of flies takes place, that he obtained the male, this sex being as one to many hundreds of females. At length he bred three males, one of which he kindly forwarded to me, and which I exhibited at a meeting of this Society. Following up Mr. Walsh's method of collecting the galls of *cynips Kollari* early in the season, that is, just at the time when they are becoming hardened, and before any flies have escaped from the fresh galls, I have tried, but hitherto without success, to obtain males of *cynips*; but I advise all who are interested in the matter to pursue the same plan, always remembering that these mysteries of nature are only unfolded at intervals, and then only to favored votaries.

"With respect to the obtaining of males of *nematus gallicola*, I believe that any one may collect, even early in the season, thousands of the galls of that insect without obtaining a male; but in all probability, by persevering season after season, his efforts will, as in my own case, be crowned with success; but I feel assured that unless the galls are gathered before any of the flies have escaped, he will have little or probably no chance of success"

Foundations for Woodworking Machines.

The following practical information is extracted from Mr. J. Richards' new work on "Wood Conversion by Machinery." The subject divides itself into two branches; one pertains to machines with reciprocating motion, and the other to machines with rotary motion only.

In respect to reciprocating machines, such as frame saws, jig saws, mortising machines, and so on, earth foundations resist vibration mainly by the inertia of their weight; that is an iron machine frame, when firmly bolted to a mass of masonry, becomes part of a whole, consisting of the foundations and the superstructure. A machine frame of one tun weight, bolted to five tuns of mason work, is in effect much the same as though the same machine frame contained six tuns instead of one tun of iron. It is, therefore, not the earth attachments which give solidity and firmness to machinery set on stone foundations so much as it is the weight which is attached to machine frames, and such a proposition at once suggests certain conditions, in constructing foundations, which are often neglected. Presuming a foundation to be an integral part of a machine, the value of such a foundation will be as its solidity, and depend upon how firmly it is bound together, and how near the whole mass, including a machine frame, approaches a solid.

To excavate a hole in the earth, and fill it with loose stones, will not make a foundation; and to attach holding down bolts to pieces of timber buried beneath masonry is to provide elasticity where rigidity is required. Anchor pieces for holding down bolts should be made of iron, and in all cases be placed beneath masonry, so that the whole mass will be bound together. Such anchors require considerable surface, and should never be narrow pieces of wrought iron, but broad castings of sufficient strength to ensure against their breaking with the utmost strain which can fall on them. Such suggestions by no means relate alone to the difference between good and bad foundations. First class foundations are often prepared with holding down bolts to embrace but a part of the masonry, and no attention is given to binding the stone work together.

In cases where such rigidity leads to the destruction of bolts, bearings, and so on, and when some degree of elasticity is essential, it is obviously wrong to place the elastic medium. whatever it may be, between a machine frame and its foundation, or to provide for the elasticity in a foundation; the proper place for introducing a yielding or elastic connection in such cases is between the crank shaft bearings and the machine frame. In this way the desired result is attained in a more effectual manner, and the evil results of jarring and vibration avoided.

When any reciprocating machine, such as a frame saw or mortising machine, has its reciprocating parts balanced—that is, when a weight equal to the reciprocating parts is attached to the opposite side of the crank—the vibration will be changed from a vertical to a horizontal plane: if the reciprocating parts are not balanced, vibration will fall mainly in a vertical plane.

From this it follows that, if the vibration of a reciprocating machine can be changed at discretion from a vertical to a horizontal plane, and *vice versa*, the counterweighting of such machines should, in all cases, have reference to, and be arranged for, the kind of foundations or attachments employed in erecting the machines.

In experiments conducted some years ago by the writer, to determine the most effectual means of resisting vibration in a peculiar kind of sawing machines, driven at from 1,000 to 1,500 revolutions per minute, it was found that a heavy crank wheel gave good results. This in effect was employing the inertia of a heavy mass to resist rapid reciprocating motion. the effect of vibration not being permitted to pass through the crank shaft bearings and be communicated to the machine frame. The experiments were such as to induce a belief that if, in designing deal and log saw frames, a portion of the metal put into the framing were transferred to the cranks or fly wheels, a higher speed could be attained. The introduction of an elastic medium, such as a spring or block of wood, between the bearings of a crank shaft and a machine frame, although seldom done, is one of the most effectual means of avoiding jar and vibration in reciprocating machines.

To sum up the means of avoiding vibration in reciprocating machines we have: (1) Solid foundations, the machine framing rigidly attached so that the whole becomes in effect one mass, to resist vibratory strains. (2) Counterweight arranged with reference to the plane in which vibration can best be resisted. (3) An elastic medium placed between the bearings of crank, shafts, and machine frames. (4) Heavy crank or fly wheels, with the crank pins inserted at or near the center of percussion.

With a proper attention to these several conditions, and by reducing the weight of reciprocating parts to a minimum, it is safe to claim that at least one third can be added to the speed of ordinary reciprocating machines, such as are employed in wood manufacture.

The main argument in favor of strong foundations for rotary machines is found in the manner in which their frames are usually constructed; the object in many cases seeming to be how many separate legs can be provided, and how long a foundation base can be secured. It adds to the apparent stability of a machine frame to have a long base, and no doubt it has such effect if a foundation is considered immovable; but it is evident that, with foundations not immovable, and such as a great share of wood machines have to be set upon, any settling or change of the foundation is communicated to the machine frame, which is thereby warped and strained out of truth in proportion to the weight of the foundation and the power of resistance which the frame offers; in this way a machine frame, instead of being supported by, may be said to support, a foundation. It is not unusual to see machines with four, six, or more legs, fastened down at as many points to upper floors, or other foundations which yield from unequal loads and from settling; tenoning machines are especially affected by being fastened in this manner, and their carriage ways get out of truth, and the frames warped.

A remedy for this difficulty is to mount machines on three bearing points, instead of four or more, a matter which every one understands, and a plan of construction well adapted to many, if not most, wood-cutting machines, yet for some reason not adopted. A machine with three legs may require more rigidity in its framing than if four or more legs were employed, that is, if we are to consider the theoretical conditions under which strain, jar, and so on are resisted; but in so far as keeping a machine in truth, and without settling strains, its performance will, in most cases, be improved by reducing the number of legs or supports.

Rough cutting is the result of imperfect balancing, loose bearings or spindles, or cutters so weak as to spring and bend, and is rarely caused by a movement of machine frames or their foundations.

So important, indeed, are balancing, stiff spindles, strong cutters, and true bearings for wood-cutting machines, that in those countries where the highest efficiency has been attained, in constructing and operating such machines, we find that massive frames and foundations are regarded as matters of secondary importance in the attainment of good work, and that the most perfect English woodworking machinery is constructed with frames of moderate weight.

There is no purpose here for arguing against strong foundations, nor even against heavy frames for machines, when there can be anything gained by either; the object is to explain that many machines which are thought to require masonry foundations can as well be operated on upper floors, as on earth foundations, and great convenience be thus attained in many cases, besides avoiding useless expense in preparing special foundations.

It is, moreover, believed that, in arranging wood factories and machine foundations, there is a want of a proper understanding as to the difference between reciprocating and rotary machines, all being looked upon as the same, and as requiring similar foundations and supports. "Have a good foundation for the planing machines; mortising machines and sweep saws can go on the upper floors," is not an uncommon remark to hear in arranging a wood factory, and a very correct one, considering the general course in a factory; but it is bad to place rotary-acting machines on earth floors, and reciprocating machines on upper floors.

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CENTENNIAL NOTES.

THE BELGIAN MINING APPARATUS.

A system of apparatus, devised by M. Chandron and designed for sinking the shafts in coal mines, is exhibited in Machinery Hall. The machines are of colossal size and form, the most prominent feature of the vicinity. There is a trepan weighing 15 tuns, which is made of forged iron, and fitted with cutters secured by taper keys, so as to make a cut six feet long. The trepan is raised by steam power to a hight of three feet, and dropped. It is turned at each elevation so that a circle, six feet in diameter, is cut. The advance in soft sandstone is said to be three feet per day. The trepan being withdrawn, a massive iron bucket is fitted into the hole to remove the *débris*. After the first tool has penetrated about 30 feet, a second trepan, much heavier than the first and having a central guide working in the opening made by the first, is used, and, in the stone above mentioned, it progresses at the rate of about a foot per day. A grapple for recovering broken rods, and a sweep to catch the sections of lifting bars, are also exhibited. There is, besides, a grapple for stones, etc., which is an ingeniously constructed pair of double lazy tongs arranged so that the arms extend to the sides of the hole as the device is being lowered, and scour the bottom as it is being lifted.

When the cutting is finished, circular plates are let into the opening, the bottom plates or cylinder sliding inside of a second ring, and being surrounded with a moss gasket compressed between the flanges. This keeps the water out of the bottom. The second ring is convex beneath and floats on the accumulated water. Then, as ring after ring is added, the water is allowed to escape, the rings sinking gradually. Guides prevent the casing from tilting until it is secured to hard impervious strata, when the shaft is pumped out and is then ready for use. This machinery and tubing has, already, we learn, been applied to 48 deep mining shafts in Europe.

RUSSIAN RHODONITE.

We have already noted the magnificent display of malachite and *lapis lazuli* from Russia. With the malachite objects are two card receivers of a very peculiar red stone, the nature of which puzzles most people. It is rhodonite, the name being derived from the Greek work for "rose," in allusion to its color. Chemically it is a silicate of manganese, and it is found in iron mines in Sweden and in various parts of Russia. Professor Dana, in his "Mineralogy," states that it has been met with in various parts of New England, and mentions a large bed as existing in Maine. Diamond dust is needed to cut it, a fact which at once accounts for the price of the articles exhibited, $2,000 each, which will probably deter enterprising New Englanders from seeking the precious mineral in their own vicinity.

RUSSIAN FURS.

Not the least interesting portion of the Russian display in the Main Building is the superb exhibit of furs, which, individually as well as collectively, are well worth studying. For example, there are some black fox skins which are so extremely rare as to be worth $300 each. No furs known are more expensive, with the single exception of the pelt of the sea otter. The color is a glossy black, usually with a silvery grizzle on the forehead and flanks. When this grizzle occurs the price falls, the pure black skins only costing such high figures. Some of the skins of Russian sable exhibited are valued as high as $125 each. This renders them, when size is considered (each skin would little more than cover a good sized rat), nearly as costly as the black fox fur. The darker the skins, the greater the value. But few such fine skins as are exhibited at the Exposition reach foreign markets, as they are monopolized by Russian royalty and nobility. It is stated that only about 25,000 sable pelts are yearly captured.

Besides these famous furs, superb skins of the ermine, squirrel, mink, fitch, seal, etc., are displayed, both in crude state and made up into robes, muffs, and garments. One robe of sable is valued at $2,000. A cloak lined with Thibet goat skin, a fine silky wool, pure white and glossy, is offered for $328. Fur rugs and carpets, almost unknown here but largely used in Russia, are also exhibited. We noticed one exquisite rug, made, we were told, of 2,400 small pieces of fur, of every kind and color arranged in tasteful designs. For the labor manifested in its execution the price asked ($250) seems small. The peculiarity of all the Russian furs is the skill shown in their dressing. Every particle of substance that can possibly be removed is scraped off the inner side of the hide, leaving the thin skin which holds the hair as soft and as fine as a kid glove. The method of preparation is also such as to render the furs moth proof, and even prolonged soaking in water has no effect on their pliability.

THE SPANISH FIBERS.

Spain and her colonies contribute a collection of vegetable fibers, which are applied to a multiplicity of useful purposes. The well known manilla is shown, crude in ten feet lengths, and manufactured into ropes, twines, carpets, and artificial "switches" for ladies heads. The pina fiber is a beautiful production, as soft and as fine as raw silk. The filaments are not taken from the stalk or leaf, as in the flax and similar plants, but are thrown out from the center of the flower. A large case of fabrics from this material is exhibited in the Main Building. The cloth resembles silk, and is superbly embroidered. There is a curiosity in the millinery line, near the same case, in the shape of a rather gaudy lady's hat, interesting, however, because made from the "peel of the common daisy." Several other plants, notably the *banot, taloto, corteza de colias, de nabo, palma de buri,* and others, yield fibers of varying degrees of fineness, which likewise are exhibited, either suspended so as to show their greatest length or wound into skeins.

TWO AUSTRIAN CURIOSITIES.

An opal, said to be the largest in the world and valued at $25,000, is exhibited in the Austrian section. It is an irregularly shaped flat stone, perhaps two inches in its greatest diameter, and comes from the mines in Hungary, whence some of the finest opals produced are obtained. Another curiosity in the Austrian section is a large chandelier made of hundreds of pieces of the finest amber. It is valued at $8,000.

THE SMALLEST STEAM ENGINE IN THE WORLD.

On the platform of the Corliss engine is, perhaps, the smallest piece of steam machinery ever constructed. It is an engine made of gold, steel, and platinum, so minute that it has for its foundation a twenty-five cent gold piece, while many of its parts are so tiny that they cannot be seen without a magnifying glass. It has a regular steam gage; and though complete in every particular, the entire apparatus weighs only seven grains, the engine alone weighing but three grains. The flywheel is three fourths of an inch in diameter, the stroke is one twenty fourth of an inch, and the cut-off one sixty-fourth of an inch. The machinery, which can all be taken apart, was packed in films of silk. The constructor is Mr. Levi Taylor, of Indianola, Iowa.

VEGETABLE TALLOW AND CINCHONA.

The leaves, fruit, and wood of the *tingkawang* tree, also the pulp, from Borneo, are exhibited in the Netherlands section. The produce of this tree is known as vegetable tallow, and is obtained from the fruit.

The tallow, carefully prepared, is used by the natives for cooking purposes. A common article, prepared with less care, is used for lamp oil, for lubricating machinery, and other purposes where fats are required. The roots of the tree are successfully applied in healing wounds, and the wood is a very good timber.

In a large case on the west side of the pavilion is exhibited an herbarium, illustrating cinchona cultivation in Java. The danger that the cinchona tree would be extirpated in South America led to an attempt at its cultivation in Java, which has been entirely successful. In 1852, cinchona plants and seeds were sent to Java, and their cultivation was commenced on a large scale. At the end of March, 1875, the government cinchona plantations contained 2,020,810 plants, of which 1,819,710 were planted in the open air and 201,100 were kept in nurseries.

There are seven plantations, having together an area of about 1,500 acres. The trees from which the bark is to be taken are cut off about eight inches from the ground and stripped of their bark, which is dried in the sun. From the base of the stems which have been cut, a number of shoots spring up, of which one or two are left, which will grow in seven or eight years to a tree that may be again cut off. The herbarium contains samples of the bark and wood, both rough and polished, showing the section both lengthwise and across the grain, the seeds and leaves of the plant and specimens of quinine, cinchonidine, quinidine, cinchonine, and a namorphous alkaloid, made from the Javanese cinchona tree.

THE DUTCH AGRICULTURAL EXHIBIT.

In Agricultural Hall, the Dutch contributions comprise a remarkably large variety of animal and vegetable products. Among the grains we notice a prepared flour so treated as always to keep fresh in the hottest climate. It is put up in hermetically sealed cases, and has we learn, been successfully subjected to the severest tests. Yeast cakes, made from corn meal and oil pressed from corn, are likewise a novelty. There is an interesting display of beet root sugar, produced by the centrifugal process. Beekeeping is represented by a few straw hives of the ancient pattern, and a dress for apiculturists consisting of a bonnet and cape of wire cloth. A large exhibit is made of canned goods, some which, the descriptive card states, were put up in 1852 and have made several voyages to India and back, remaining in excellent condition. Cod liver, rapeseed, linseed, and other well known oils are represented by samples of much clearness and purity. Dutch flax, hand-scutched and mill-scutched, is shown, the fiber being from three and a half to four feet long. A specimen from New Zealand is almost as white and as glossy as silk fiber. Especial attention is directed to the white blossom linseed, which is exported from America to be manufactured into oil. The fiber of this flax is coarser than that of the blue blossom; but it is said to be superior in value. A very marvelous piece of work, partly the handiwork of nature and partly of art, is shown in a lattice or screen, the meshes of which are about six inches square, and formed of interlaced twigs which have grown into each other at the intersections. The lattice is about 8 feet high and 5 feet broad, and the rods are 1½ inches thick.

TROPICAL WOODS.

Over 1,500 specimens of woods from the Philippine Islands are shown in the Spanish Government building. The specimens are about eight inches square, one side of each being polished and the other plain, and one end is shaved down in a bevel to show the grain. The bark is also left on the block. Amomg the more valuable of these woods is the narra, a reddish brown timber resembling walnut, and sometimes showing a bright red color, which variety is more highly esteemed. It is in demand for cabinet work. A large plank of this wood, which is 7½ feet wide and 11½ feet long, is on exhibition. Very many varieties are marked as valuable ship timbers. These are tough, close-grained woods, and oak and teak, the latter resembling live oak or black walnut.

In this collection of woods is shown a mahogany log from Cuba, about 25 feet long and 18 inches square. The value of this timber for veneers may be appreciated from the fact that the Commission has been offered $2,000 for this stick. Other woods from Porto Rico and Cuba are also exhibited with that from the Philippine Islands. The prices at which these woods are contracted for, cut, at the province Tayabas, as a principle producing center, are for the narra timber, 1 foot square and 30 feet long, $5 in gold, and the same for the molave timber.

In the same building is a piece of rattan 550 feet long and only 1½ inches in diameter at the butt. It is coiled up like a cable.

RAMBLING NOTES.

NUMBER I.

WATER WHEELS AND THEIR MAKERS.

"I saw Root last week for the first time in three months. He has a first rate mill site out on the Pappillion, and has just finished his mill. He expects to start up next week. In speaking of the wheels he had purchased, he brought forcibly to my mind a business principle well worth considering.

"He had his own prejudices regarding wheels, as every mill man has, but before ordering he sought and received my advice on the subject. I may state here that I have my prejudices on the water wheel question as well as he, and I will further state that he ordered three wheels, neither his own pets nor the ones I had recommended. When he first spoke to me about the matter, I recommended a certain wheel and at the same time gave him the addresses of all the wheel builders in the country. Last week, at the meeting mentioned, he told me his story. He had written similar letters to all the builders, stating the case and soliciting terms, financial and dyramical. He received many courteous replies and gorgeous catalogues. The respondents explicitly stated that in the last seven years they had sold such a number of wheels—had replaced such a number of So-and-So's wheels—have 200 wheels running in the State of New York alone—'a wheel of our make was placed in the mill of Mr. Sample in New Jersey, under circumstances identical with those named in your letter, and performed perfectly satisfactorily—have several wheels in your county and enclose you addresses of users who will speak for them—send you herewith names of 1,000 users of our wheels, which list speaks for itself of their merit—think three of our new forty inch wheels will suit you—call your attention to our prices—call your attention to the fact that all the wheels in use in our own county are of our make—enclose you Mr. Emerson's report of test of our wheels—advantage of turbines over overshot wheels no longer a question,' and numberless more such items. But one concern wrote as follows: "Three of our forty-two inch wheels, placed as you state, will do the work specified in your letter. Would be pleased to receive your order with that understanding." Now here is a party not afraid to say 'will,' and the banks say Y. 18. Of course the wheels were ordered from these last parties, who seemed to know something about what their wheels will do, as well as what they have done. Root says he cannot lose, even if the wheels fail. The concern furnishing them is responsible, and under the circumstances the price does not become a matter worth consideration.

'There may be a moral to Root's story worthy the attention of manufacturers of the solid order. I mean, of course, solid capital behind solid merit in the product."

THE WASTE OF COAL BY SMOKE.

"From my office window I can see a paper mill chimney of imposing hight. Night and day for two years, that chimney has not ceased to belch out its solid volumes of smoke, solid enough apparently to hold up the chimney if the positions were reversed. That smoke must cost the mill owners a great deal of money; and a great deal of it finds its way into my office in the form of palpable soot. The fact is that this whole smoke business is an abatable nuisance and a sign of waste. Furnaces constructed especially for the economical consumption of fuel are required, on general principles, to burn the smoke. It is not found difficult to so construct a furnace as to attain this end. Smoke is composed of carbon which is visible, and hydrogen which is invisible. Had these products, when first set free in the furnace, been supplied with exactly the proper amount of oxygen, they would have turned into carbonic acid and have been consumed. The proper adjustment of the combination of these gases forms the basis of design for smoke-consuming furnaces.

"But plenty of furnaces are now in use in places where it is desirable to burn the smoke, without entirely reconstructing the furnace or going to any such expense. Many ingenious contrivances have been invented, intended to be a simple attachment to the ordinary furnace and to answer the purpose of originally designed smoke consumers. They consist generally of peculiar dampers or peculiar doors, of air holes behind the bridge wall, or of some arrangement of steam jets in the furnace. The behavior of some of these affairs is remarkable. Some fail entirely, some succeed perfectly, while some burn the smoke, but at great expense.

"Any ordinary coal-burning boiler furnace may be made to consume nineteen twentieths of its smoke, and to effect some slight saving in fuel, without any alteration, and without a penny expense, by proceeding as follows: First,

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if you have been in the habit of using a poker, trade it off for a hoe. Next fire as usual, and, if it is not raining too hard, go out and take a look at the top of the chimney It is bound to be smoking. Now with the hoe push all the burning coal a little back, so as to leave a foot of the front end of the grate bars uncovered. Now throw in fresh coal on this clear part, quite a lot of it. It will now burn from its inner edge, which becomes coked, the escaping gases passing over the glowing coal further in the furnace. The process of firing consists in pushing these coked portions back into the fire, and putting fresh coal on the side of the heap nearest to you. You will notice that by this plan of firing you never put any coal into the fire at all, but into what may be called a coking oven, and you burn only coke. All coals, clinker, etc., are moved inward, and as a consequence the clinker will all have to be taken out at the back end of the grates. For this purpose a door in the side wall, level with and at the back end of the grate, will be found more convenient than engineering the clinkers around to the front door again. This method of firing is almost universal in England, where municipal law fines a smoking chimney. One objection to the process is that the charges of fuel, being light, must be pushed forward frequently, keeping the furnace door open a great deal. Notwithstanding this fact, the plan will be found very satisfactory.

SHAFTING, HANGERS, AND PULLEYS.

"Dixon has recently been replacing one of his line shafts. He has been telling me for the last two years that the thing was annoying him. He has made a clean sweep this time, and I hope he is now at peace. He bought that shaft, with its hangers, couplings, and pulleys, in Boston when he first started his shop. It was his main line then. It was only one and fifteen sixteenths in diameter, and the pulleys had wretchedly gotten-up set screws in them. He says he bought the stuff with his eyes shut, and I believe him. About a year ago the receiving pulley on this shaft slipped a little and gouged a couple of rings in the shaft. Last month the shaft twisted off at that place, which is the best thing that ever happened to it, for it made Dixon mad and he superannuated the whole thing. Even the pulleys he laid aside for other purposes. The hangers, when lying on the floor, look as though they had a world of drop, but in reality it was only ten inches, and they had been put up with nine inch wooden blocks to lower them. They had a fearful lot of metal in them, for they dropped about two feet and then turned up again. That's what made them look so imposing when on the floor. They were fancy-looking affairs, all the orders of architecture having been called into play in their design. Dixon threw them in his scrap pile. The shafting was not at all nice, being very irregular, and the pulleys were poor fits. The couplings were of the modern taper sleeve variety, and looked first class in every way, but were always troublesome. They were all right when the shaft was in perfect line, and they were all right when the shaft was very much out of line, as was the case once when a new Daniels planer was put in the pattern shop above. But when the shaft was just a little out of line, as most shafts are, those couplings would squeak and "chaw" the shaft, and work off. Nothing could be done for them but lining up the shaft, which seemed to be the only thing which ought to be done; but the floor above was not substantial, and it would disarrange the shaft in a very short time. In putting up his new shaft, Dixon has stiffened this floor as much as possible, and put up hangers with twenty inches drop, with solid cast iron boxes and glass oilers. The old boxes were self oilers, but gave trouble. He has enlarged a portion of this shaft, as ought to have been done at first, and put on all the pulleys in halves. He says it cost him fifteen dollars every time he put a new pulley on the old shaft, or changed the order of hose already on. He has put on the ancient style of flange coupling, which looks very much like retrogression; but my own experience has been about like Dixon's, and I expect I should have done about the same thing. His couplings are provided with an outer sleeve a foot long, which covers the bolts. Without these sleeves I believe these flange couplings to be the most murderous pieces of metal about a shop. His pulleys are the neatest I have ever seen. Most of these two-part pulleys look very clumsy.

SELF-OILING BOXES.

"Speaking of self-oiling boxes, I was told of a Cincinnati firm who sold a complete mill outfit, with all boxes on the self-oiling plan. The customer reported trouble with the boxes, and further inquiry elicited the fact that no oil whatever had been supplied to them at the trial start. The self oiling feature had been depended on for supply as well as regulation." LEFTWICH.

THE FAIR OF THE AMERICAN INSTITUTE.

Despite the existence of the Centennial Exposition, the present Fair of the American Institute is likely to be as interesting, in point of novelties displayed, as any of its late predecessors. The same, we think, will be found true of other local exhibitions. Both from the size of the Centennial and from the limited time which most visitors thereto have at their disposal, to the foreign exhibits is given the greatest share of attention; and many home contributions, which in smaller collections would be narrowly scrutinized, are there overlooked, or at least but cursorily examined. Local fairs, therefore, viewed as domestic advertising mediums, really offer superior advantages to the great international display; and the recognition of this fact, by manufacturers and others, doubtless accounts for the non-diminution of the usual number of entries in the American Institute building. On the part of the Fair managers, it is evident that exertions have been made to render the show more attractive, both to exhibitors and to the public. New decorations, quite tasteful in their way, a new and handsome fountain, an attractive-looking, though poorly stocked, Japanese bazaar, and various other improvements have been added. The general arrangement of the hall, however, is the same as during former years; and we can dispose at once of a large share of the miscellaneous exhibits by stating that they offer a like similitude. As at every recurring fair there is some one prominent contribution of especial interest, so there is to this one, in the shape of

THE POTTERY DISPLAY.

Visitors who are familiar with the exquisite ware of France and England will see, doubtless, little to admire in the two neatly arranged exhibits of the Union Porcelain Works of Brooklyn and of a New York manufacturer; but on the other hand, those who have watched the progress of the pottery industry in this country will see, in the ambitious attempts at majolica ornaments, Parian statues, and like objects hitherto only imported into the United States from Europe, an advance both rapid and full of promise for the future. We have before us a French journal in which one of the French artisans, who had been sent to this country to examine the Centennial Exposition and who has returned, warns his trade publicly that the competition of the United States in the manufacture of fine pottery is greatly to be feared. Probably the best we can do in fine porcelain is that shown at the American Institute Fair. The taste displayed in ornamenting is sometimes questionable; but the work is there, and there is plenty of artistic ability in the country to supply the needs when once its attention is directed to the subject. In the Brooklyn factory's display, quite a handsome vase is exhibited, commemorative of the Centennial year. Scenes from the national history are executed in bas relief in panels around the base; on the sides are medallions of distinguished men, and the handles are bisons' heads. The painting is appropriate and tasteful, and as a piece of pottery it is of excellent fineness. There is also in the same exhibit a commemorative cup, showing some fine modeling work which is worth examination.

THE MACHINERY DEPARTMENT

is now a chaos, but we are promised a host of new things. The driving engines are three in number; an 80 horse power Wheelock, a Brown engine of similar size, both models of admirable workmanship and finish, and a Hampson & Whitehill 40 horse power machine. There is the inevitable and omnipresent Baxter engine in its various sizes, possessed of a new interest through being attended by a lady engineer. A new yacht engine, said to be of 5 horse power, built by Harsen, of Greenpoint, is a neat, compact, and very small machine, which seems excellently suited for small boats. The cylinder is vertical and inverted, and there is a new and simple reversing gear, which consists of a rod moved to and fro in an inclined slot in an eccentric, thus changing the latter to one side or the other, and so, through the eccentric rod, controlling the motion. The device, which might be termed a single link, works excellently. Celluloid emery wheels, composed of a mixture of celluloid and emery, are exhibited at work. They seem to have the advantages of not glazing, they run with little noise and few sparks, can be used with water, and the wheel at the Fair has cut a clean square-edged notch in an old file, a good piece of test work.

Of course the band and jig saws are out in full force, and the popularity of the Chinese puzzles and toy frames and furniture which they manufacture shows no sign of waning. We notice a new tool interesting to woodworkers, called a friction feed cut-off saw. The friction feed is obtained by passing a strap, which connects the treadle and the vibrating saw carriage, over a friction pulley which is always revolving when the saw is in motion. By pressing lightly on the treadle, the band is tightened over the pulley, and the latter thus pulls the saw forward to its work. There is also a new gage and measuring attachment, placed transversely across the front of the table, consisting of a perforated plate and sliding stops thereon, which last is connected with a pin and knob by a rod. In using, the pin is placed in the hole on the plate corresponding to the length to be cut, and the stop is thus moved to the exact distance from the saw indicated in inches by the scale. This is done very quickly and so saves time. A new gear wheel is exhibited in model (why, we fail to perceive, as opportunities might easily have been afforded for showing full sized wheels at work), made after a new process, the V-shaped teeth being forged or pressed by the action of a die revolving in contact with the heated blank wheel, which likewise rotates. Advantages claimed are absence of flaws, accuracy, strength, no back lash or lost motion, etc. Veneered pulleys are novelties, and seem to be a cheap and fair substitute for ordinary wooden pulleys. The peripheries are made of three layers or veneers of ash. The pulleys run true and easily. They are not visible in actual use, and hence no further opinion is possible. Exhibitors fail to consult their best interests when they show devices idle, which can easily be displayed in operation. This is becoming a too common error at the American Institute Fairs. The mechanical public, the interest of which it is hoped to enlist, is not at all inclined, under such circumstances, to accept assertions of advantages on faith.

Handasyde's Composition for Boilers.

Messrs. C. H. Handasyde & Co.. Dunleith, Scotland, have recently established an agency at 24 Broadway, in this city (see advertisement on another page), for the introduction of their anti-incrustation composition for stationary boilers and locomotives in this country. The composition has been tested on the railroads and in collieries and ironworks to a great extent in England and Scotland; and we have before us a long list of the names of the most extensive manufacturers abroad who are using the article at the present time. Mr. G. C. Campbell, the agent in this country, has instructions from the manufacturers to make no charge to users of the composition unless it accomplishes all that is claimed for it; and they modestly state in their circular that they "refrain from claiming for their composition any advantage over others of a similar nature, but ask for a fair and unprejudiced trial, so that its real worth may be ascertained."

The Patent Business of Great Britain.

In the year 1875, the applications for patents made in Great Britain and Ireland numbered 4,561, being 69 more than in 1874. The increase is less by 129 than that of the previous year, and this diminished rate of growth is fairly attributable to the depression of trade.

The British patent statistics enable us to form an idea of the proportions of inventions in that country that have any substantial value. For instance, in the year 1875, 1,173 patents were not carried further than the six months provisional protection, which is the preliminary period for which patent is granted; and as a rule, only 28 per cent of British patents survive their third year, and 10 per cent their seventh. Small as this business appears in our eyes, the considerable fees exacted from patentees realize altogether a very large income, the year 1875 yielding a revenue of over $550,000 in gold after all expenses were paid. This sum is about the average amount; and since the office was remodeled in 1852, over $6,150,000 has been paid into the public exchequer. The claims of Science are now being urged upon the Government; and it is to hoped that, in consideration of the large revenue yielded by the patent office, the proposed Science Museum may be established. A site on the Thames embankment has already been suggested for the purpose, and a plan for the institution is published in the Patent Office Report for 1875, recently issued.

DECISIONS OF THE COURTS.

United States Circuit Court--Northern District of Ohio.

HARVESTER PATENT.—HENRY F. MANN *vs.* EDWIN BAYLISS.

[In Chancery.—Before Emmons, C. J.—April Term, 1876.]

EMMONS, J.:

In this cause complainant's bill recites that he is owner of letters patent of the United States, dated February 28, 1871, being a reissue and extension of letters patent No. 15,044, dated June 3, 1856, said reissued letters patent being numbered 4,281, for an improvement in harvesters, complainant having been one of the original patentees, and having acquired the interest of his co-patentee, Jacob J. Mann, by an assignment from said Jacob's administrator.

The improvement consists, in brief terms, in having an elevated side delivery of the cut grain in the straw, by means of an endless apron, whereby the grain is discharged into a stationary receiver, of concave form, from whence by means of a revolving rake, the teeth of which describe a circle nearly coincident with the circle of which the concave receiver forms a segment, the grain is gathered into gavels of suitable size for binding into sheaves or bundles. The bill prays answer, account of profits and damages, and injunction in the usual form.

The answer denies originality and novelty of the invention, as also infringement, in that whereas by complainant's device the grain is discharged into a receiver which is "concave" in form, the machines constructed by defendant discharge their grain into a receiver which is "flat and horizontal," from which it is taken by the binder without the use of the revolving rake.

On the hearing the question turned mainly upon the 4th claim of complainant's patent, which is in these words:

"4. The stationary concave receiver I, having a continuous surface, arranged as described at the side of a harvesting machine, having an elevated side delivery so as to receive the cut grain from the elevating and delivery apparatus, and collect the same into gavels preparatory to their being discharged from the machine."

Held, that the device employed by the defendant is essentially different in form from that employed by complainant, as described in said 4th claim, and does not constitute an infringement as charged in the bill.

Complainant's bill dismissed with costs. Notice of appeal to the Supreme Court.

The opinion of the court in this case was delivered orally, and was not reduced to writing, and this report is made by the clerk.

[*Geo. H. Christy* and *Wm. Bakewell*, for complainant.

S. A. Goodwin, for defendant.

DECISIONS OF THE COMMISSIONER OF PATENTS.

IMPROVEMENT IN SHUTTER HINGES.—HARVEY LULL.—EXTENSION.

[In the matter of the application of Harvey Lull, for the extension of letters patent of January 2, 1854, No. 10,477.—Decided July 27, 1876.]

DOOLITTLE, Acting Commissioner:

This application for the extension of the above named patent was made under the authority of the Act of Congress, approved April 29, 1876. It was once extended for seven years, from the 21 day of January, 1868, which term expired the 2d day of January, 1875.

From the *Congressional Record*, in which the proceedings relating to the acts above cited were printed, it is shown that this case was very fully discussed in both Houses of Congress. No opposition was made there, or has been made before this Office, since these proceedings commenced. Over sixty prominent manufacturers in various large cities signed the petition that applicant made to Congress.

The invention consists in the construction of a shutter hinge with projections and bevels, so that it may lock itself automatically when opened.

The Examiner imports the invention to be novel at the time of the grant of the original patent, and proof shows that no self-locking hinge made at an earlier date has been introduced into the market to any considerable extent. Nor does it appear that any similar invention patented since that time has superseded it. The proof also shows that the invention is valuable and important to the public to the extent of many hundreds of thousands of dollars, that less than $10,000 profit has been realized by the inventor from the sales of the article, and that nearly all of that has been consumed in litigation.

The Examiner reports, and the proof substantiates his statement, that these hinges have been sold in quantities sufficient to fit 2,160,000 windows; and it is estimated that the public has been saved in breakage, wear and tear, and extra fastening, to the amount of $540,000. The inventor is now very old and poverty-stricken, with a wife and several children depending upon him for support.

It is also shown by numerous affidavits and other evidence that the effect of the proposed extension upon the public interest will be good, inasmuch as it will prevent the manufacture of cheap, lightly constructed wares, and will continue the manufacture of a valuable hinge in the hands of those who will construct it in proper shape and of durable material.

The applicant has fully complied with all the requirements of the law and Office practice entitling him to the extension of his patent. Very rarely has a more meritorious case been presented, and it is without hesitation that the extension applied for is granted.

Recent American and Foreign Patents.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED CHIMNEY FLUE CLEANER.

James Grimes, Portsmouth, Ohio.—This invention consists of spring acted wing sections of the cleaner brushes, which are locked to the stem until the same is carried up in the chimney by means of jointed links. The wings are released by a cord running down along the stem.

IMPROVED WATER ELEVATOR AND PURIFIER.

Conrad Hartzell, St. Joseph, Mo.—This invention causes a current wheel located on a float to operate a pump, which draws its water through a submerged tube, at the bottom of which is a filter. The object is to afford a constant supply of pure water.

IMPROVED BALANCED THROTTLE VALVE.

Hubbard Hendrickson, Red Bank, N. J.—In opening the valve, the movement of a stem first moves small additional valves, which are easily moved and admit the steam. The latter passes to the other side of the main valve and equalizes the pressure so that it can be moved freely.

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IMPROVED PAPER-CUTTING MACHINE.

James Harding Brown, Porter's Mill's, Wis.—This consists of a lever fixed to swing horizontally around a vertical axis in a fulcrum standard over a cutting table, and carrying two roller cutters. The latter are adjustable for cutting wider or narrower strips. There is also a roller gage for pressing on the sheet of paper to hold it in place.

IMPROVED RAILROAD CAR TRUCK.

Laban B. Lyons, Chillicothe, Ohio.—This invention relates to the construction of the metal side frames of the truck, to the means for connecting and suspending the brake beams, and also to the form, construction, and arrangement of other parts. For particulars, see patent.

IMPROVED TIRE UPSETTER.

Edward W. Holt, Corinna, Me.—In order to easily and quickly upset the tires of wagon wheels without changing the form of the tires or cutting them apart, this inventor provides a pair of arc-shaped jaws, with fluted cams, that engage with fluted lugs on the jaws to clamp the tire. One of the jaws is fixed to the bed piece, and the other is capable of being moved in ways in the bed by an eccentric pivoted to the bed and bearing against a roller in the movable jaw. The jaws are forced together to upset the tire.

IMPROVED ROAD SCRAPER.

Addison Shanklin, London, Ohio.—This invention has reference to such improvements in road scrapers that the handles may be locked securely to the scraper bowl by bolts, which may be readily lengthened when worn, so as to keep up the reliable locking of the parts.

IMPROVED STEAM VACUUM PUMP.

William V. Dubois, Covington, Ind.—This relates to the construction and arrangement of the working chambers, air chambers, and valves, and particularly to the contrivance of the valve for changing the admission of steam to the working chamber, and to a vacuum chamber for relieving the jar at the foot valve in the end of the pipe in the wall.

IMPROVED RAILROAD SWITCH GUARD.

Frank B. Peace, Maryville, Tenn., assignor of one third his right to Elijah Walker, same place.—This invention consists of guard rails, with projecting parts or heads pivoted at both sides of the switch rails. The engineer is enabled to see readily, by the projecting guard rails, whether the switch is set or not, and has time to slacken speed and put on brakes, so that the catches or heads serve as stops to the train without throwing the same off the track.

IMPROVED MACHINE FOR STRIPING PAILS.

Samuel R. Henry, Stillwater, Minn.—This invention consists of a chuck for holding the pails, striping rollers, a roller for supplying them with paint from a paint box, carrying and guiding rollers, and a contrivance for raising and lowering the chuck to facilitate the application and removal of the pails.

NEW HOUSEHOLD INVENTIONS.

IMPROVED FOLDING TABLE.

Wilber F. Bartholomew, St. Louis, Mo.—The legs of this table slip into standards, and are supported therein by spiral springs. They thus may be, by spring catches or like devices, adjusted so that the table will remain at any desired hight. With this construction, it can readily be raised to a convenient hight for use as a cutting table, and, when in use for ironing or sewing, can be lowered and drawn over the lap.

IMPROVED NURSERY CRIB.

William H. Thompson, Columbus, Ohio.—This is a crib having two sides hinged to bottom, two sides hinged to the corner posts, and two divisions hinged at the bottom. This allows of the device being folded into small compass.

IMPROVED FLAT IRON HEATER.

Franklin A. Powell and Susanna L. Robinson, Pontiac, Ill.—The body of the sadiron has an angular socket which receives the lower portion of the handle. The part of the handle that attaches to the iron is made to fit the socket, and is cut down to allow a latch to swing over it and under a hook attached to the iron.

IMPROVED WASHING MACHINE.

Micajah D. Martin, Marietta, Iowa.—This is a novel lever contrivance to a rocking rubber pivoted in the axis of a tub. The object of the lever is to enable the operator to work the rubber by an easy purchase, and, at the same time, to stand sufficiently distant from the tub to avoid the steam rising up from the soapsuds.

IMPROVED HANGING SPITTOON.

John C. Winton, Muddy Creek, Tenn.—The object of this invention is to provide a spittoon, so constructed as to adapt it to be suspended upon a wall or other vertical support. The device consists of a saliva box or receptacle of suitable form, provided with or attached to a plate extended upward, and having a flange around its edge to prevent the saliva ejected against the plate from escaping over its edge and to guide it into the aforesaid receptacle.

IMPROVED STARCH BOILER AND STRAINER.

William H. Whitlock, New Albany, Ind.—This device admits of the starch being strained instantly after boiling without being poured into another vessel, dispensing thereby with straining through a cloth, and burning of hands. It consists of a vessel with interior strainer, sliding therein by a bale. When the starch is ready for use the strainer is placed into the vessel and bushed to the bottom of the same, so that the liquid starch will flow through the strainer, while the lumps will be carried to the bottom of the boiler.

NEW AGRICULTURAL INVENTIONS.

IMPROVED HAY LOADER.

Caleb Loader, East Pennard, England.—This relates to certain improvements in that class of hay raking and loading devices in which the frame which carries the endless elevator is made jointed, and with an upper movable section; and it consists in the means for operating the said jointed section. Said section is adjusted as required through arms, by means of cords and pulleys, worked by a handle. The section is also arranged in connection with a suitable elevating device.

IMPROVED FLOOD FENCE.

Wiley C. Barber, Rockmart, Ga.—In this device an eccentrically pivoted log, with a number of upright pins or stakes, forms a rack that gives readily for the passage of drift wood, and readjusts itself automatically.

IMPROVED POULTRY COOP.

Markus Ehlbert, Greenville, Ala.—This inventor arranges the bars or grating forming the sides and top of a coop in such a way that they may be folded compactly together. The object is to provide a coop which may be used for shipping poultry, or a crate for other articles, which may be folded in small compass for reshipment.

IMPROVED WHEEL HOE.

Rudolph Vampill, Mullins, S. C.—This consists of a pair of hoe plates secured in a diamond-shaped frame. At the forward end of the latter a wheel is journaled. The wheel may be adjusted to cause the hoes to work at any desired depth in the ground. A suitable handle is attached to the frame.

IMPROVED ADJUSTMENT FOR HARVESTER PLATFORMS.

Samuel Noxon, Jr., Ingersoll, Ontario, Canada.—The novel feature in this device is a simple arrangement of a lever and gearing which serves to lower the grain table, thus adjusting the cutters to any desired hight.

IMPROVED SEED PLANTER AND FERTILIZER DISTRIBUTER.

John C. Fooshe, Greenwood, S. C.—This relates mainly to the construction of the hopper, the bottom of which is made in sections, which are caused by suitable mechanism to rise and fall. The effect is to work the guano out of the hopper and also to crush all lumps. The material is afterwards guided to the ground by a suitable guide plate.

IMPROVED CIDERM ILL

John Thomas Griffin, Grant, Tenn.—The essential features here are a perforated crib, resting on a platform, in which the juice is expressed from the crushed fruit by a follower, operated by a lever hooked under a yoke, and prevented from driving the yoke together by a bar.

IMPROVED PLOW.

Stephen M. Harris, Forest Grove, Oregon.—The new feature here is a clearer for preventing the clogging of the colter or standard, where it is connected with the beam, with stubble, weeds, and the like. The said clearer is a kind of shovel blade fixed on a spring support over the beam. The support couples with a wheel fixed so as to roll along the ground and work the clearer forward and backward.

IMPROVED PLOW.

Robert C. Traweek, Blanco, Tex.—The plows are attached to bars which may be turned on their pivots so that the plows will always be equally distant from each other, and will be square with the line of draft. The bars may also be adjusted to any desired angle with the beam, and are held securely in place when adjusted.

IMPROVED PLOW.

Judson S. Hartzell, Addison, Pa.—This plow is so constructed that the parts most subject to wear can be readily detached when worn, and replaced with new ones, and when in use will be held firmly to their places. A flange is formed upon the standard and mold board, and recessed upon its inner and outer sides to receive the two parts of the landside, which are bolted to each other and to the flange.

IMPROVED CULTIVATOR.

John C. Bannigan, Dunleith, Ill.—This includes a variety of new mechanical devices. By means of one, the draft may be attached in such a way as to protect the plants from being injured, by another the plows and beams may be adjusted, and by another the driver's seat is caused to balance the forward draft.

IMPROVED HORSE HAY RAKE.

Henry H. Hathaway, Clockville, N. Y.—This invention is a horse hay rake, so constructed that it may be used for heavy raking, and for light raking or gleaning, may be easily dumped to discharge the collected hay, will adjust itself to uneven ground, and will not scratch or catch upon the ground. The novelties here are all in mechanical construction. The rake is susceptible to a variety of uses including heavy as well as light raking or gleaning. The revolution of the wheels acts to cause the teeth to drop collected hay. Devices are provided whereby the machine adjusts itself to uneven ground, and the hay is prevented from rolling or twisting in the rake.

IMPROVED LAND DRAG AND CLOD CRUSHER.

John M. Crockett, Dallas, Texas.—This invention is an improvement upon the clod crusher and drag for which letters patent No 177,476, were granted to the same inventor, May 16, 1876. In that implement a series of flat metal bars are secured, in ranks or rows, to front and rear wooden crossbars, each of said metal bars having two curves so arranged that they alternate in position with the curves of the contiguous bar or bars, for the purpose of more quickly reducing the clods to a pulverulent condition in passing over them. The object of the present invention is to simplify the construction, reduce the cost, and increase the efficiency of the drag. The metal bars are divided into two parts, and each part curved and attached separately to a crossbar.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED SPOKE SOCKET.

Henry Oldendorph, Waterloo, Ill.—This invention consists of plates provided with shanks, and so formed as to fit upon the side of a felly and spoke, to fasten said spoke when broken off at the shoulder of its tenon.

IMPROVED GATE.

George W. Calkins, Milton, Wis.—This gate is so constructed that it may be opened and closed by a driver without his leaving his seat in the vehicle. A slotted lever receives a pin attached to the lower part of the gate, and passes through a space between the parts of one post and is pivoted to said post. The upper end of the lever passes through a slot in the upper bar of the gate frame and is pivoted to a bar that slides thereupon. To the sliding bar, toward its ends, are attached the ends of two cords, by pulling upon one of which the gate will be opened, and by pulling upon the other the gate will be closed.

NEW MISCELLANEOUS INVENTIONS.

COMBINED GLOVE STRETCHER AND HAND MEASURE.

Moses Greensfelder, Harrisburg, Pa.—This consists in the combination of a hand measure with a glove stretcher, the measure being so arranged within the handle of the stretcher as to be capable of being drawn out for use. It is caused to regain its position in the handle by means of a suitable spring.

IMPROVED REVOLVING SHOW STAND.

Orange P. Gould, Lewisburg, Pa.—Three spider frames are mounted on a spindle at suitable distances apart, for holding shelves, on which the goods are to be placed. The said frames are made of cast iron, and made to revolve on shoulders of the spindle, which keep them in their respective positions. Arch bars are provided for connecting the spider frames outside the shelves, and are arranged with loops and pins for that purpose.

IMPROVED ARTIFICIAL MARBLE.

Richard Guelton, New York city.—This is a process for imitating fine black marble without veins, and also for reproducing artificial incrustations on the marble. A cement is mixed with animal black, and after it is set the pores are filled with more cement, previously colored. Then follows the application of nitrate of iron, etc., and polishing. There is an ingenious method for imitating veins, and a process for rendering the marble acid-proof.

IMPROVED METHOD OF TANNING.

Alpheus M. Barnes and William F. Yocom, Weston, Mo.—The hides, after being limed, are bated in a mixture of soft water and corn meal. They are then strained out and are ready for the dress liquor, which is prepared of soft water, salt, sulphuric acid, sulphate of potash, and buttermilk. After handling, the hides are placed in a tan liquor, prepared by adding to each 100 gallons of extract of bark liquor, suitable quantities of salt, sulphate of potash, and sulphuric acid. Then follow strengthening, scouring, soaking in gambier liquid, and lastly preparing in sumac liquor. The invention also includes a process of tanning hides with the hair and fur on, by subjecting them to the action of a dress liquor, and then treating them with a composition of half-strength lye.

IMPROVED ADJUSTABLE ARM REST.

Moses Shoemaker, Plattsburg, assignor to himself and Charles J. Nesbit of Platt City, Mo.—This is a device for supporting the aam when writing upon the lower part of the page in large, thick books. It may also support the side of the book in a level position when writing upon the thinner part of the book, or upon a page of a book so bound that its sides will drop or incline when said book is opened.

IMPROVED CARBURETER.

Martin Schmidt, Houston, Tex.—This invention is an improvement in that class of carbureters in which air or gas is forced through a chamber filled with absorbent material that has been saturated with hydrocarbon. By a novel arrangement, by opening a stopcock, more or less gas will pass to the burners without passing through the carbureter. By opening it fully, none of the gas will pass through the carbureter; and by closing it fully, all the gas will pass through the carbureter.

IMPROVED LARD OIL LAMP.

John Roemer, Champion, Mich.—This invention consists of pipes for receiving the heat of the flame, and conducting it down into the oil chamber for warming the oil: the object being to make lard oil lanterns capable of use in very cold weather.

IMPROVED ELLIPSOGRAPH.

Henry C. Root, San Francisco, Cal.—This is an ingenious instrument, excellently suited for the uses of architects, engineers, and others. By turning a crank the pen will describe an ellipse, with the long axis coinciding with the face of one standard, and the short one in similar relation to the face of a second standard. By adjusting the centers so as to coincide, that is, one above another, a true circle may be struck. The size of the figure described by the pen may be closely regulated.

IMPROVED BARREL STAND.

David Scott, Olney, Ill.—This device furnishes a storage place for barrels, protects them from dust, etc., and is so constructed as to allow of their being tilted easily. The barrel can be adjusted to any desired hight for drawing off its contents.

IMPROVED ADJUSTABLE POCKET BOOK FASTENING.

Daniel M. Read, New York city.—This consists of top and bottom plates, having each a corrugated channel, in combination with a face plate, having a catch on both sides. The shoulders of the channel receive the catch between them, so that the catch can have no lateral movement, and cannot slip out from between the plates.

IMPROVED HITCHING POST.

Charles F. Roth, Winterset, Iowa.—This invention consists of a bell-shaped metallic case, in which a vertical bar, slotted at its upper end for the attachment of a halter or bridle, is retained by a spring catch bar; the latter being released from the vertical bar by means of a key so constructed as to press when turned on its upwardly inclined inner end. A spiral spring surrounds the lower end of the vertical bar, and presses it up, exposing the slot when the spring catch bar is released from it. The hitching bar has a rounded hemispherical head, which, when the device is closed, rests upon the bell-shaped case.

IMPROVED MACHINE FOR STRINGING TOBACCO LEAVES.

Louis Strasser, Columbus, Ohio.—This consists essentially of a needle lying on a bed, so arranged and being so confined that a vibrating pusher, worked rapidly by a foot-power mechanism, is made to push the leaves on the needle and along it to the string attached to the head, and also along over a rod or wire, from which the leaves are to be hung, half from one side and half from the other. The arrangement is such that the leaves can be strung as rapidly as two persons can present them from opposite sides in front of the needle.

IMPROVED BRIDLE.

Daniel T. Van Antwerp, Prophetstown, Ill.—This is an improved attachment for bridle headstalls, to enable the horse's head to be raised or lowered, as desired, and to enable an unruly or vicious horse to be more readily controlled. The invention consists in adjustable straps attached to the headstrap of a bridle headstall, and in overdraw straps which are drawn together at their middle parts, their lower ends being secured to the bit rings. The overdraw straps have gag runners attached to their ends to receive the check rein.

IMPROVED BUSTLE.

Mrs. Alwilda Swallow, Shelbyville, Ill.—This consists of a bustle, made of one piece of spring wire, and bent to form two bows, of which one is larger than the other. Said bows are arranged at a suitable angle and connected by coiled springs, to which the belt is attached. The bustle has no sharp edges to cut the clothing, and is light, cool, and strong.

IMPROVED BALE TIE BUCKLE

Thaddeus Bunker, Cuero, Tex.—This consists in half-ring bars, having small half-ring hooks formed upon their ends in the opposite direction, which secure the ends of a bale band by clamping the inside end of the band edgewise, in a manner not to cut or strain the band, but to make it an impossibility to slip or give way.

METHOD OF TIPPING AND PATCHING BOOTS AND SHOES.

David T. Cooper, Jackson, Mich.—By the old method of putting on tips or patches, the tip or patch is retained by sewing through the outer sole all around, which presents an unfinished appearance, while requiring a great deal of labor. By the present method a tip, patch, or foxing may be put on the shoe in a few moments, and without ripping up the heel seat. The invention consists in doubling up the edge of the tip, patch, or foxing, inserting a wire into the folded part, and fastening the wire by forcing the ends through small awl holes of the outer sole, and by intermediate wire clips, which are drawn up tightly, twisted, and clipped off or clinched on the outside of the sole.

IMPROVED TOBACCO STICK HOLDER.

Thomas A. Eanes, Leesville, Va.—This is an implement for holding the stick on which the tobacco leaves are hung after cutting, saving thereby the labor of the hand required for holding the stick while the cutting hands hang the tobacco. The invention consists of a metallic post, driven in the ground, with retaining fork or foot piece, and top bracket and clamp, to support the tobacco stick.

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Notes & Queries

R. K. will find directions for tempering rock drills on p. 202, vol. 31.—W. F. will find that greasy cotton waste is very liable to spontaneous combustion. See p. 26, vol. 33.—M. S. will find a recipe for purple ink on p. 315, vol. 33.—J. N. W. can nickel plate his iron castings on p. 235, vol. 33.—C. S. will find a recipe for preserving timber on p. 265, vol. 33.—W. F., J. R. C., W. M., J. C. W., and others who ask us to recommend books on industrial and scientific subjects, should address the booksellers who advertise in our columns, all of whom are trustworthy firms, for catalogues.

(1) B. J. H. says: What will restore the skin to its natural color after being tanned by exposure to the sun? A. Use a paste made of precipitated chalk and glycerin, and avoid exposing the skin to the influence of strong sunlight or winds.

(2) J. B. H. asks: What will remove the tar of tar weed from woolen cloth? A. Try benzine or naphtha.

How can I make my clock run slower? A. Lengthen the pendulum.

Can you give a simple process for making potato starch? A. Convert the potatoes into a pulp by means of a scraping knife or an instrument similar to a nutmeg grater; throw the pulp upon a fine linen cloth in a large funnel,and allow pure cold water to run through the mass slowly for several hours. By this means all of the minute starch granules may be washed through the cloth; and on allowing the water to stand for some time, these will settle to the bottom, and may be removed by decanting the water and straining.

(3) A. B. asks: How can I stain basswood to imitate Spanish cedar? A. Use logwood.

(4) A. H. asks: Which is the most approved kiln for burning charcoal? I hear that, around Lake Superior, retorts resembling those for gas or pyroligneous acid are used, the object being solely production of charcoal. Is charcoal burnt in retorts equal to that burnt in kilns? A. The finer qualities of charcoal are made by distilling the wood in closed retorts such as you mention. By this method several other valuable products, such as illuminating gas, creosote, pyroligneous acid, etc., are obtained.

(5) J. S. says: I have been using cowrie copal, which dissolves readily in alcohol. I now wish to use Zanzibar copal, which will not dissolve in alcohol. Can you tell me what will dissolve it? A. Zanzibar copal is soluble in ether.

(6) H. B. M. asks: 1. Is it not a fact that carbonic acid gas under certain compression becomes heavier than sea water? A. No; liquid carbonic acid is lighter than water. 2. If a pressure of thirty-six atmospheres will liquefy it, does not that degree of pressure exist in the deeper portions of the sea? A. Yes; but the acid would speedily be dissolved by the water, and gradually escape to the surface. 3. Does pressure arrest decomposition or chemical change? A No. 4. If carbonic acid gas be generated at the bottom of the ocean under a pressure which will render it heavier than water, can that liquid rise through the water to the surface? A. Yes. 5. Should chemical action in the depths of the ocean set more gas free than the undisturbed water above can absorb, is it not possible that below a certain depth the ocean rests upon a subocean of liquefied carbonic gas, and may not the fact, noticed in the deep sea soundings, "that material brought from the bottom is strongly charged with carbonic acid" be attributable to the imprisonment of the gas by the pressure of the water above it? A. This is not at all probable; when the water has been taken from great depths, it has, in some instances, been found to be heavily charged with carbonic acid. 6. If investigation should prove the existence of a large body of carbonic acid gas beneath the ocean, might not the fact of its known electrical affinity throw further light upon the action of the tides and other terrestrial phenomena? A. We do not see what possible influence this could have on the tides, etc. 7. Would affirmative proof of the above justify the conjecture that the absence of tides in the lakes might be due to the want of sufficient depth to compress the gas to a sufficient specific gravity? A. No.

(7) H. C. asks: Please give me a recipe for extracting the mildew and shop stains from fine kid gloves. A. Draw the gloves over suitable wooden hands, and treat with a little putty powder and benzole.

(8) H. & L. say: Please tell us of a cheap plastic cement that can be used as a substitute for lead in lining wooden tanks to hold sulphuric acid. A. We do not know of such a cement that can be recommended.

(9) J. E. T. asks: How can I clean tallow? A. Digest it for some hours with dilute sulphuric acid; the pure tallow will separate and rise to the surface. The application of chlorine, which you suggest, is not necessary.

(10) C. C. asks: If I make a pump by taking 4 pieces of plank 6 inches wide, 1½ inches thick, and nail them together, and leave the hole square and work a wooden rod in it, having valves at the bottom of the pipe, can I raise water 112 feet without bursting the pipe? A. If you fasten it well, with bolts or straps, it will answer.

How is the horse power of boilers rated? A. Makers generally rate the horse power of a boiler by the amount of heating surface, and consequently by the size.

(11) H. F. L. asks: Can you tell me of a solution and process,which is a cheaper substitute for $AgNO_3$ in printing from a negative,which will give as good a print as silver? A. No.

(12) P. R. says: 1. What is the highest degree of heat that water can be raised to in a boiler ⅔ full? A. With sufficient temperature in the furnace, the limit would only be reached at the melting point of the material of which the boiler was constructed, provided, of course, that the boiler was of sufficient strength. 2. Can steam be raised to a greater degree while in the same boiler, and what degree will steam attain by separating it from the water and superheating it? A. The steam can be superheated in either case, to the same limits as before. 3. Is the top or boiler head of a steam boiler ⅔ full of water any hotter with 100 lbs. pressure than with 10 lbs. pressure? A. Yes, because the temperature increases with the pressure.

(13) W. H R. asks: What is the best way to mix paint for the red staff to staff millstones with, water or oil? A. We think oil is generally preferable.

(14) N. W. J. says: 1. I am using a force pump located over a well, with 24 feet of suction, and force the water 25 feet up into large tubs. The suction pipe is 2½ inches in diameter, the discharge pipe 3 inches, running on a level with the pump 70 feet, then up through the bottom of the tub, without a check in the pipe. The pump has a 12 inch valve. When running, the valves and piston thump heavily. How can I remedy it? A. Air vessels should be employed. 2.Does a pump in working form a vacuum? A. Yes, if it lifts water.

Will ice transmit the rays of the sun, so as to affect the thermometer? A. Yes.

(15) C. A. D says: I want to build a boat, with flat bottom, to be propelled with a wheel behind, with a one horse power engine. Of what size should the boat be? A. You can use a boat 15 feet long and of 3½ or 4 feet beam; but the engine is rather too small.

(16) W. R. P. asks: How can I wind up a line 60 inches long with a uniform tension of, say, 1 oz., without interposing a fusee? A. You can do it by means of clockwork actuated by a weight: or if you wish to use a spring, it should be quite long, and the clockwork should have an escapement with a pendulum or balance wheel. In other wards, the problem that you have proposed is precisely the same as occurs in the manufacture of clocks and watches.

(17) A. L. B. asks: What is the hight of the tallest mast of a sea-going vessel? A. The Three Brothers, said to be the largest sailing vessel in the world, has a mainmast 99 feet 10 inches high. If there are vessels with higher masts, probably some of our readers will be kind enough to send particulars.

(18) W. A. P. says: 1.I have a small engine with two oscillating cylinders 3½ inches long and 2 in diameter, with a 3 inch stroke. I wish to put it in a small side wheel steamer. Please give me the dimensions of which to make the boat and the paddle wheels. A. Boat 18 to 20 feet long; wheels, 2 feet in diameter. 2. I want to make a boiler for the above. Of what dimensions should it be to furnish steam enough? A. Make it 2 feet in diameter and 3½ or 4 feet high. 3. What would such a boat cost without the engine? A. From $20 to $50, according to character.

In "Wrinkles and Recipes" you give a recipe for coating iron with mercury to prevent rust. My engine is all polished. Would it do to coat it accordingly? A. It might answer very well.

(19) L. D. B. says: I have a well that affords about three fourths enough water for my boiler. Can I turn my escape pipe into the well and condense the steam by means of a pipe to run water from my reservoir into the well over the end of the escape pipe, shooting it out in fine spray? A. The plan does not seem very promising, as it requires several times as much water,as a given volume of steam was formed from, to condense that steam.

(20) J. O. H. Jr. says: 1. I have an engine and boiler. Size of engine cylinder is 4½ x 8 inches; the boiler is a double flue, 6 feet 4 inches long and 2 feet 4 inches in diameter. What size of flat-bottomed boat could I run with such an engine, running the engine 5 revolutions to 1 of the wheel? A. Boat 30 feet long and 6 to 7 feet beam. 2. Of what size should I make the wheel? A. Propeller 20 inches diameter, 3½ to 4 feet pitch. 3. What speed would the boat make against a current of 4½ miles per hour? A. You might realize 3 miles an hour.

(21) A. T. asks: What is the best metal for lining the sides of a box in which the plunge of a tile mill works, in order to wear the least? A. We think you will get very good results by using Bessemer steel.

(22) L. B. asks: 1. Is there any danger of an explosion in making soldering fluid, that is, by throwing pieces of scrap zinc into a glass jar containing muriatic acid? The jar sometimes gets heated to 120° Fah. A. There is no danger provided the gas (hydrogen) which is evolved is allowed to escape into the air without contact with flame. 2. Is it very injurious to health to inhale the fumes of the acid, while boiling? A. The acid vapors are poisonous. 3. Can you inform me as to a safe and proper way of making it? A. The operation should be conducted in the open air, in a large wide-mouthed porcelain or stoneware jar. To avoid the first violent action it is better to dilute the acid with thrice its volume of water.

(23) F. E. J. says: I want a cement that will resist dilute sulphuric acid and carbonic acid gas. I need something equal in strength to plaster of Paris or sealing wax, sufficiently strong to hold a light vessel in place. Can you aid me? A. Try paraffin, plaster of Paris soaked in melted paraffin, or solution of caoutchouc.

(24) D. C. D. says: You give a description of a baroscope, made by placing a glass tube in a bottle partly filled with water, and blowing a column of water up the tube, when the hight of the column of water will vary with the pressure of the atmosphere. What cement can I put around the cork to make it airtight and hold up the column of water? A. A rubber stopper is best for this purpose; it should be well greased with a little cerate, and forced in as tightly a possible. Where it is not possible to obtain a suitable rubber stopper, choose a good cork one, immerse it for a short time in melted paraffin, and, when the pores are well filled, force it into the neck of the bottle tightly and hold it in position until perfectly cool.

What cement will cement hard rubber and glass together and resist the action of ordinary writing inks? A. Melt together in an iron pot equal parts of pitch and gutta percha. This may be kept liquid under water.

Will nickel resist the action of ordinary writing inks as well as silver? A. No.

(25) H. C. N. asks: What will dissolve tin, bismuth, and lead (both severally and together), without acting upon copper or silver? A. We do not know of such a reagent.

(26) O. O. W. asks: How can I compute the amount of heat generated in an air pump at, say, 100 lbs. pressure, with thermometer at 60° Fah.? A. By using the following formula: T=absolute temperature of air before compression; t=absolute temperature of air after compression; V=volume of air before compression; v=volume of air after compression; P=pressure of air before compression; p=pressure of air after compression. Then $\frac{t}{T}=\left(\frac{V}{v}\right)^{0.408}=\left(\frac{p}{P}\right)^{0.29}$. This equation can be most readily solved by the use of logarithms, thus: $\log.\left(\frac{t}{T}\right)=0.408\times\log.\left(\frac{V}{v}\right)=0.29\times\log.\left(\frac{p}{P}\right)$.

(27) J. H. P. says: 1. I wish to prepare a plaster of Paris mold for making bee comb foundations. How can I harden the mold so that it will not break or crumble under pressure? A. Mix the dry plaster with a solution of alum in water in place of pure water. 2. Beeswax in thin sheets is very frail and breaks easily when cold. What can I add to it to toughen it? A. Try fusing the wax with a little resin.

(28) W. C. T. asks: Is there any material, of which soft, pliable gloves can be made, that will stand hot water and be durable? A. Gloves of leather and of Macintosh cloth (cloth filled with caoutchouc solutions), etc., have been used for this purpose, but were soon discarded. We do not know of anything that would be an improvement upon these.

(29) J. E. A. asks: How can I remove kerosene oil stains from a marble slab? A. A paste made of soda, pumicestone, and chalk is recommended,after the application of which the marble is to be washed with soap and water.

Can steel or chilled iron balls be turned perfectly spherical? A. It is better to grind them.

How are what are called rephotographs produced? The photographs seem to be first transferred to glass by some method,and then touched up on the back with oil paints. Will you give me a description of the *modus operandi*? A. See p. 359, vol. 31.

(30) C. W. T. says: J. C. J. can lower the tone of his tuning fork by filing the tines thinner close to the handle.

(31) A. H. & S. G. ask. 1. What is the best rail for railroad purposes, namely, for strength and safety, irrespective of cost? What should be its length, size, and weight? A. A committee of the American Society of Civil Engineers recommend a steel rail weighing from 52 to 56 lbs. per yard; hight from 4 to 4½ inches: head 2⅜ inches wide, 1¼ inches deep: top of head curved to a radius of 12 inches; thickness of stem $\frac{7}{16}$ to ½ inch; width of base 4 to 4½ inches; thickness of base at edge $\frac{3}{16}$ inch, rising at an angle of 14°. 2. What is the effect of cold on the best rail? A. The committee think that rails break in winter because they are weaker, and the road bed is less elastic. Other prominent engineers do not think that the rails are weaker in cold weather, and believe that good rails are no more liable to break in winter than at any other season. 3. What is the nature of the strain upon a rail by the passing over it of a train of cars? Is it tension or impact? A. A rail is subjected to tension or compression because it acts as a beam between supports. It also has to resist blows or impact, and the imposed weight tends to crush it, in addition Besides this, its section is reduced by wear.

(32) C. C. asks: In a first class condensing engine, cutting off at one sixth, what is the pressure in cylinder at the end of stroke, supposing that in the boiler to be 60 lbs.? A. About ⅙ of the pressure at point of cut-off.

(33) H. P. says: There is a spring, affording water enough to fill a 6 inch pipe, 400 rods from and 70 feet above the village. To bring water from this spring to the village with force enough to throw to the tops of buildings, what size of pipe will be necessary? A. Unless you use a very large main, the head will be so much cut down that the hight of discharge will be quite small. It would probably be cheaper to use a smaller main, and have a pump and standpipe in the town.

(34) J. M. says: I make a fluid from galls, sulphate of iron, and sulphate of indigo; when I neutralize the sulphate of indigo with marble dust, there is a violet-bluish film on top of the ink; filtering does not remedy it, as the film soon collects again. What is it, and how can I get rid of it? A. Your solution after filtration is probably too concentrated. Add a little more water.

(35) L. L. T. asks: How can I color russet leather red and white? A. For red, use an alcoholic solution of aniline red, not too strong. We do not know of any method of coloring the leather white, except it be by the superficial application of some light-colored pigment, such as zinc white (oxide of zinc) and finely ground barytes (sulphate of baryta), rolled in with gum arabic solution.

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(36) C. R C. says: In Fowne's "Chemistry" it is stated that picric acid is also one of the ultimate products of the action of nitric acid upon indigo and numerous other substances, as silk, etc. The way to produce it from indigo is given in detail. Will the same method answer for silk? A. Yes; but the quantity of the acid obtainable from this source is small, and difficult to isolate from the numerous other products of the decomposition. Its presence among these products is, therefore, only a matter of scientific interest.

(37) C. Roggenkamp, of Appingedam, Holland, asks: 1. What is quicklime? A. It is the anhydrous oxide of calcium. It is commonly prepared from limestone or marble (calcium carbonate) by ignition in a kiln. The carbonic acid is thus driven off, together with the moisture. 2. What is plaster of Paris? A. It is the anhydrous sulphate of lime ($CaSO_4$).

(38) J. C. M. asks: How can I make ferrotartaric acid? A. Dissolve pure sulphate or chloride of iron in distilled water, and add to this a strong aqueous solution of pure soda (or carbonate of soda) in excess; heat nearly to boiling, filter, wash the precipitate thoroughly with hot water, and dry. Then add to this an equal weight of citric acid, and about 20 times its weight of pure water, and allow to stand at a temperature of about 170° Fah. for 24 hours in a covered vessel. Dilute a little if necessary, filter, and evaporate the filtrate (which contains the acid tartrate of iron) to dryness over a water bath.

(39) E. W. W. asks: How can I take bluing stains out of a red and white crumb cloth? A. If ordinary bluing were used, boiling in a little hot water should remove the stain. If not, let us know what kind of bluing was employed, and in what way.

(40) C. H. H. asks: What is the best method of generating carbonic acid gas for use in soda fountains? A. The materials commonly employed are dilute sulphuric acid and coarse marble dust. Use marble dust 10 lbs., water 30 lbs. (about 4 gallons), oil of vitriol 15 lbs.

(41) H. T. D. asks: 1. How can I coat metal with hard rubber? A. Cover the parts well with gum rubber, and then heat in melted sulphur until the degree of vulcanization desired is reached. Experience will best teach you the proper conditions. The efflorescent and adhering sulphur may be removed by hot solutions of potash or soda. 2. What shall I use for covering a rack for holding work in a plating solution, to prevent deposit, and also to resist the action of soda or potash lye? A. Try successive coatings of solution of caoutchouc. It would be better to make a rack of glass, or glass and hard rubber (ebonite).

(42) J. J. W. asks: What is a good brown dye for straw hats? A. Try the following: First dry the straw thoroughly, then steep for a short time in a strong solution (neutral) of sulphate of copper. On removing the material from this, dry again, and immerse for about five minutes in a weak solution of ferrocyanide of potassium.

(43) H. J. asks: I have a set of rabbit furs. They are soiled by the hair. How shall I clean them? A. We do not know of a less objectionable method than that of the application of benzole (not benzine) and some absorbent material, such as paper pulp (dry and warm) or pipe clay.

(44) P. R. H. asks: 1. Please give me an analysis of the purest Lake Superior native copper? A. It consists, generally, of pure copper, but often contains both silver and mercury, sometimes as much as 7 or 8 per cent of the former. 2. Of what are the ridges on copper implements composed? A. They are probably points that have been covered with organic or other unchangeable material, that has offered more or less protection to the metal beneath. The non-corrosion of the metal at these points may also to some extent be attributable to the small masses of silver which are sometimes found with the copper. 3. Can copper be cast? A. Copper may be cast, but the castings are, for the most part, useless, owing to their non-homogeneous character, and the numerous blowholes which they contain. 4. Are there any castings made of pure copper? A. No.

(45) A. H. says: In Machinery Hall at the Centennial, I saw in the exhibit of a compressed air railroad brake a wooden ball, dancing in a strong current of air which was escaping from the apparatus. Please explain why the ball did not leave the stream of air and fall to the ground. A. The explanation, with diagrams, was published in SCIENTIFIC AMERICAN SUPPLEMENT No. 37.

(46) J. H. L. asks: How can I get a humming or whistling noise out of a tin tube attached to a wheel of 2½ inches circumference? The tube is 1 inch long by ⅛ inch wide, and the wheel runs at 60 turns a minute. A. It will probably be necessary to allow the tube to project some distance beyond the rim of the wheel, with one side a little longer than the other.

(47) C. C. P. and others.—The aniline colors are not, in themselves, poisonous; the poisonous qualities are attributable to the small trace of arsenical compounds to be found in almost any of these commercially prepared dyes. It has been found necessary to employ arsenic acid in the preparation of these beautiful and, at present, indispensable colors; and the best that we can do, under the circumstances, is to avoid placing any colored fabric suspected to owe its tints to the aniline dyes, in contact with the cuticle, especially of children.

(48) C. J. H. asks: 1. Is there any way to determine the presence or absence of carbolic acid, chloride of lime, and copperas in a mixture of gas tar and brick clay? A. Yes, but we do not think it probable that notable amounts of the substances enumerated would be likely to exist in such a mixture. 2. If so, can I do it myself? A. It would require the skill of a chemist. We do not think that any instructions we could give you here would enable you to make a satisfactory analysis of the material.

(49) D. W. H. says: I am engaged in manufacturing an article into which liquid ammonia of 16° proof enters largely. I am informed that it can be made very cheaply from sulphate of ammonia and lime, and that the apparatus for making 25 to 60 gallons per day is not expensive. What do I need in the way of apparatus? A. All that is requisite is a large iron retort in which to heat the mixture of ammonia salt and lime, and a suitable absorption apparatus, preferably a series of large Woulfe's bottles, partially filled with pure cold water. The proportion of caustic lime and ammonia salt employed should be about equal weights. In order to free the ammonia gas from impurities before dissolving it in the water, it is advisable to pass it through an iron worm surrounded by cold water, and then through a strong solution of potash.

(50) C. C. B. says, in reply to a correspondent who asked as to the origin of the $ mark: By the ancients the pillars of Hercules (Gibralter) were regarded as marking the end of the world; and the two pillars are displayed on ancient coins, bearing a fillet between them with the motto *ne plus ultra* (nothing further, or nothing beyond) On the discovery of America by Columbus, Spain, with pardonable vanity, stamped her dollars and other coin with the same pillars, and threw between them a fillet bearing the motto *plus ultra* (further yet). The mark $ thus designated the Spanish dollar, and in time the American.

(51) J. W. W. says, in reply to J. A. P. who asked how to make apple butter: Take any quantity of fresh unfermented cider and boil it down to half its quantity. Then add fresh ripe applies which are quartered and deprived of their cores. Continue the boiling, stirring all the time with a wooden paddle to prevent burning and adhesion to the sides of the kettle. The boiling is to be continued until the butter is of the proper consistence, when it is put away in jars or kegs for use. If the butter is made properly, it will keep all winter in a perfect state of preservation

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

R. M.—Both specimens contain gold.—W. S. V.—No. 48 contains a considerable quantity of iron pyrites. No. 49 is orthoclase, a silicate of alumina, iron, lime, and potassa.—No. 50 is not of natural occurrence. It is a furnace product, probably spiegeleisen, a carburet of iron containing manganese.—L. W. S.—The curious piece of wood you send us appears to have been taken from the shell immediately surrounding the pith of the log, and has subsequently been subjected to a process of rolling or pressure. which has imparted to it its remarkable suppleness and strength. We should like to have further particulars concerning the material, as your letter is not quite clear. —H. G. S.—It is spiegeleisen, a carburet of iron containing manganese. It is not an ore.—D. A. C.—It is hornblende.—J. M. L.—It is trap rock containing iron pyrites.—E C.—It is hornblende with quartz containing iron pyrites or sulphide of iron.—J. D. S.—It is a limestone (marble), but contains too much alumina to be useful for lithographic purposes.—J. W. G.—It is a species of rock very closely resembling that employed for lithographic purposes. It might, we think, answer for that purpose.—W. W. S.—It is a sand formed by disintegrated granite of quartzose rock, containing minute spangles of iron pyrites, but no silver.—G. L. W.—It is a quartzose rock slightly discolored by iron. It may contain a small quantity of gold, but this could not be determined without a qualitative analysis.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On a New Form of Chuck. By C. R. W.
On Locomotive Drive Wheels. By G. C.
On Working Men's Demonstrations. By J. G.
On Keeping People Employed. By D. M.

Also inquiries and answers from the following: J. D. F.—E. M. S.—H. F. W.—E. T. P.—B. L. T.—W. N.—J. C. D.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Enquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Who sells nautical instruments? Where can gyroscopes be bought? Whose is the best lightning rod? Who sells photographic apparatus? Why do not makers of guns and rifles advertise in the SCIENTIFIC AMERICAN? Who makes drop presses? Who sells portable boats, that can be folded up?" All such personal inquries are printed, as will be observed, in the column of "Business and Personal." which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

September 5, 1876,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn &Co., 37 Park Row, New York city.

Advertising desk, J. D. D. Mortimer 181,863
Advertising device, H. H. Browne (r) 7,292
Air vent and collapse valve, R. J. Malcolm 181,791
Anchor, D. Z. Evans 181,928
Auger, fore, G. N. Stearns 181,874
Bale ear, L. Wirthlin 181,810
Bait kettle and cooler, J. C. Hitchcock 181,844
Bale hoop tightener, Knowles *et al* 181,949
Bale tie buckle, T. Bunker 181,818
Barrels, making, T. M. Healey 181,889
Base-burning stove, A. White 182,004
Base-heating stove, G. H. Johnson 181,942
Basin, catch, H. Frank 181,931
Basin cock, Forns & Mooney 181,929
Bed-bottom spring, L. C. Boyington 181,816
Bee hive, G C. Wilson 182,009
Beer cask, M. Seitz (r) 7,297
Beer vat, G. Meurer 181,962
Bell toy, I. A. Bevin 181,902
Blowing machine. J. G. Baker (r) 7,291
Boiler furnace, H. M. Smith 181,991
Book cover protector, J. Mahedy 181,956
Boot-sewing machine, W. Jackson 181,941
Boot tip, J. A. Pease 181,974
Boot blacking apparatus, M. Simon 181,801
Boots, tipping and patching, D. T. Cooper 181,821
Breech-loading fire arm, J. Fiedler 181,810
Brick machine, E. Sprague 181,803
Broom-winding machine, M. Gollaher 181,935
Cabinet for braids, F. E. Goehring 181,834
Cam attachment, engine, W. H. Wilson 182,010
Can, metallic, G. L. Harrison, Jr 181,783
Cane and seat, Smith & Jacoby 181,802
Car coupling, D. P. Cubberley 181,916
Car couplings, R. A. Kelly 181,946, 181,947
Car coupling, W. S. Owen 181,971
Car coupling, A. Wald 181,807
Car coupling, R. K. Welch 181,884
Car replacer, J. Booth 181,766
Car wheel, L. Le May 181,854
Carburetor, C. Edgar 181,926
Card grinder, M. A. Furbush 181,933
Carrier for barrels, etc., N. Oak 181,797
Cartridge shell, J. P. Pieri 181,977
Chandeliers, protector for, F. J. Symmes 181,877
Child's carriage, Carter & Fox 181,907
Chopping knife, E. G. Cushing 181,918
Churn, M. B. Cresswell 181,913
Churn, E. A. Oliver 181,966
Churn, W. M. K. Thornton 182,001
Churn dasher, A. McDaniel 181,866
Cider and wine press, Cowley *et al* 181,775
Cider mill, J. T. Griffin 181,839
Clasp, A. M. Butler 181,819
Cloth-cutting machine, A. Warth (r) 7,304
Clothes pin, U. D. Mihills 181,861
Cockle separator, H. Kurth 181,786
Cocoa nut grater, S. Croft 181,914
Coin, storing and counting, W. Cunningham 181,773
Compound engine, C. E. Emery 181,780
Cooking stove, D. Stuart 181,996
Cooling mines, etc., T. Joseph 181,945
Corn marker and coverer, W. Dolenty 181,922
Corn planter, Frederick *et al* 181,932
Corn planter, Galt & Tracy 181,832
Corn planter, hand, J. Downing 181,825
Corset, S. B. Ferris 181,781
Corset, H. H. May 181,960
Corset clasp, A. Ottenheimer 181,970
Cracker machine, J. H. Mitchell 181,862
Cultivator, T. J. Jones 181,944
Desulphurizing ores, W. O. Davis 181,776
Defecation of solutions, H. Leplay 181,856
Ditching and tile laying, J. F. Young 181,887
Door check, J. Pierce 181,865
Dough, raising, W. & R. L. Skillen 181,989
Dovetails, cutting, Bahse *et al* 181,897
Draft attachment, Luther *et al* 181,955
Draft equalizer, J. Beard 181,765
Drill teeth attachment, G. W. Crooks 181,915
Drive chain, J. H. Elward 181,779
Earth auger, H, W. Pulse 181,983
Egg beater, Boon & Colburn 181,903
Electric alarm, A. Bradford 181,905
Evaporator, register, W. R. Fowler 181,930
Extension table, W. S. & A. D. Seaman 181,986
Feeder, thrashing, J. W. Dozier 181,923
Fertilizer, G. J. Popplein (r) 7,296
Fertilizer distributor, P. P. Linder 181,858
Fires in oil tanks, etc., preventing, J. H. Connelly 181,911
Floating power, J. L. Shipe 181 988
Folding table, W. O. Osgood 181,969
Frame for curtain fixtures, E. L. Lloyd 181,952
Fruit dryer, J. W. Seymour 181,987
Furnace grate, R. C. Graves 181,837
Furnace, ore-roasting, J. Winterburn 181,886
Gage, diameter, R. D. Williams 181,809
Gage for hair cutting, Bow *et al* 181,904
Game table, J. B. Butzbach 181,769
Gang plow, E. A. Beers 181,901
Garden and field hoe, D. B. Sherman 181,870
Gas apparatus, A. Glachet 181,934
Gas pressure indicator, etc., W. W. Goodwin (r) 7,301
Gas regulator, A. Strausz 181,875
Gate, J. M. Richardson 181,985
Gate, farm, J. W. Baker 181,898
Gate valve, J. Banister 181,899
Glass mold trimmer, J. Zihlmann 181,888
Glass-polishing machine, E. Ford 181,831
Glove safe, S. Lewy 181,951
Governor, steam engine, G. F. Ernst 181,927
Grain band, J. H. Swihart 181,876
Grain binder, W. Lottridge 181,954
Grate bar, Allen and Barton 181,892
Gridiron, G. Cornwall 181,823
Grinding phosphates, H. Ducsh 181,924
Grindstone frame, J. E. De Freest 181,919
Gunpowder pile driver, F. C. Prindle 181,932
Gutters, making wooden, A. W. McCausland 181,794
Gymnastic apparatus, P. Graham 181,836
Hair-puffing pin, A. Hurd 181,847
Hair triggers, etc., G. O. Leonard 181,855
Harrow, S. Kain 181,849
Harrow, J. G. & J. H. Stokesbary 181,995
Harvester, W. Lottridge 181,953
Hat fastener, C. C. Shelby 181,872
Hats, pouncing, R. Eickemeyer 181,829
Hay elevator, Young & Carroll 182,012
Heater for fire engines, W. S. Reynolds 181,799
Heating air for furnaces, etc., G. W. Broc 181,767
Hinge, H. L. Hapgood 181,813
Horseshoe nails, making, J. A. Huggett 181,784
Hose pipe, Hovey & Leshure 181,940
Ice cream freezer, C. W. Packer 181,972
Ironing board, D. H. Bagley 181,813
Knife cleaner, R. A. Barker 181,764
Lamp extinguisher, L. Homann 181,938
Lamp-filling tube, C. Chinnock 181,909
Lasting machine, G. W. Copeland 181,772
Lathing, metallic, J. W. Kensett 181,850, 181,851
Leather boot tips, making, A. Vanwagenee 181,002
Line fastener, A. C. Swoards 181,998
Liquid measure, W. K. Johnston 181,943
Lock and chain fastening, W. R. Edelen 181,925
Locomotive steam brake, etc., T. J. Shellhorn 181,869
Loom shuttles, threading, T. S. Parker 181,798
Marble cleaning, D. Love 181,790
Mechanical movement, H. E. Towle 181,805
Middlings separator, J. B. Martin 181,957
Milk can cover, Dunlap *et al* 181,777
Milk cooler, G. N. Horton 181,939
Millstones, staffing, W. N. Cosgrove 181,774
Mop head, H. H. Mason 181,958
Music leaf turner, J. Collicott 181,771
Musical building block, H. Eckhardt 181,827
Nail plates, cutting, L. Soule 181,993
Nest for fowls, C. Haise 181,840
Nut lock for rail joints, G. McGregor 181,961
Paper box, D. K. Osbourn (r) 7,295
Paper-feeding machine, J. T. & F. Ashley 181,895
Paper wire, reducing strain on, J. H. DeWitt 181,921
Paper sheathing, etc., J. F. Ellsworth 181,778
Paraffin, purifying, F. Q. Barstow 181,814
Pianoforte action joint, F. Preston 181,866
Pile-driving mechanism, E. Larkin 181,788
Pipe mold, A. O'Neill 181,967
Planing machine, E. G. Allen 181,893
Plow, J. S. Hartzell 181,842
Plow, M. P. Sparks 181,873
Potato digger, D. D. T. Brown 181,768
Poultry coop, M. Ehlbert 181,828
Press, sugar-molding, A. de la Montagnie 181,920
Puddling furnace, J. Pedley 181,975
Pug mill, H. Aiken 181,890
Pump, W. H. Pollard 181,980
Pump, continuous discharge, S. D. Lount (r) 7,302
Pump plunger and valve, J. Matthews 181,793
Pump, steam and vacuum, J. D. Willoughby 182,005
Railroad rail, compound, R. W. Thompson 181,878
Railroad signal, automatic, G. Gledhill 181,833
Railroad switch, C. Hughes 181,785
Railroad switch locks, A. W. Willcox 182,007, 182,008
Railway car wheels, manufacture of, A. Krupp 181,853
Refrigerator, P. J. Kromer 181,050
Register mechanism, duplex, Towle *et al*, (r) 7,290
Rivets, etc., making, G. A. Gray, Jr 181,782
Rocking chair, H. Lamprecht 181,787
Rotary engine, J. M. Poisley 181,981
Ruffler, sewing machine, E. J. Toof 181,879
Sad iron heater, W. H. Haylock 181,937
Saws, sharpening, J. McSweeny 181,795
Sawing machine, G. T. Riddle (r) 7,303
Scroll sawing machine, E. Anderson 181,762
Seed planter and cultivator, W. J. Pirkle 181,978
Self loading cart, A. Vreeland 181,882
Set screw, R. S. Barnum 181,763
Sewing machines, operating, J. N. Sutherland 181,997
Shackle bolt fastening, F. Armstrong 181,890
Shank support, etc., boot, J. S. Nelson 181,965
Ship's galley, W. Young 182,011
Shoe fastening, C. F. Kleinschuster 181,948
Shoe fastening, C. M. Platt 181,979
Signaling flag, Couch & Lamb 181,912
Skate, roller, C. W. Saladee 181,868
Slate frame attachment, R. Parke 181,973
Sleeping car, G. Leve 181,857
Snow, melting, Mullaly & Hawkins 181,964
Spader, etc., stalk cutter, P. D. Pelsor *et al* 181,976
Spading, plowing, etc., W. M. Mathes 181,959
Spectacles, S. F. Chandler 181,908
Spinning spindle, J. C. Stanley 181,804
Spinning top, A. Kern 181,852
Spoke tightener, J. W. Gray 181,838
Spooling thread, etc., J. W. West 181,885
Steam boiler, R. M. Beck 181,904
Steam boiler, H. Purdy 181,867
Steam engines, kindling fires of, C. L. Scoville 181,800
Steam radiator, W. B. Snow 181,992
Stop cock, T. Leavitt 181,789
Stop cock and washer box, G. B. Hooton 181,846
Stove pipe, L. Colburn 181,910
Stove pipe collar, Oplinger & Whaley 181,864
Straw cutter, W. H. Hall 181,844
Street lamp, C. C. Charles 181,770
Stud or sleeve button protector, Bacon & Fox 181,896
Stump puller, C. C. Adams 181,811
Sucker rod extractor, G. M. Sheffer 181,871
Sugar into cubes, compacting, W. Wadsworth 181,883
Surveying instrument, M. W. Venable 181,881
Table and writing desk, C. W. Miles 181,963
Tea pot bodies, etc., making, Bayley 181,815
Temporary binder, R. M. Merrill 181,796
Tension regulator, Wheeler & Coy 181,808
Tesselated floors, S. P. Groocock, (r) 7,293, 7,294
Thill coupling, H. J. Iles 181,848
Thread cutter, sewing machine, J. M. Stamp 181,994
Ticket recorders, E. R. Brown 7,299, 7,300
Tire upsetter, E. W. Holt 181,845
Tobacco stick holder, T. A. Eames 181,826
Toy arrow discharger, W. W. Algeo 181,891
Tree transplanter, T. Carroll 181,820
Truck, warehouse, J. J. Deal 181,824
Tubing chain winch, O. H. Smith 181,990
Turntable for traction ways, J. Britton 181,817
Tweer, C. H. Burbridge 181,906
Umbrella holder, G W. Marble 181,792
Valve for steam pumps, Cope *et al* 181,822
Vehicle spring, A. K. Stone (r) 7,298
Ventilating cap, etc., pipe, F. Greaves 181,936
Ventilator cowl, C. A. Valle 181,880
Vibrating joint, etc., water pipe, J. Curran 181,917
Vinegar, making, Tait & Ford 181,999
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9,485.—PICTURE FRAME.—A. Griffin, Meshoppen, Pa.
9,486.—STOVES.—R. Hatchman, Detroit, Mich.
9,487.—GATES.—W. Tweeddale, Brooklyn, N. Y.
9,488.—LAMPS.—G. D. Burton, New Ipswich, N. H.
9,489.—WOOL FABRICS.—D. L. Einstein, New York city.
9,490.—COAT.—F. Kellogg, Chicago, Ill.

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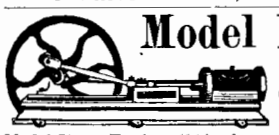

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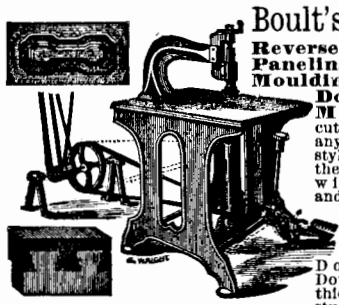

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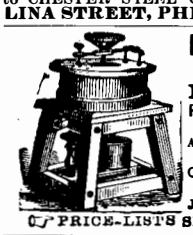

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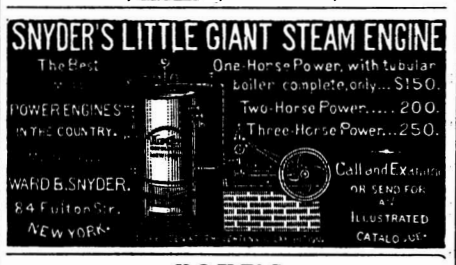
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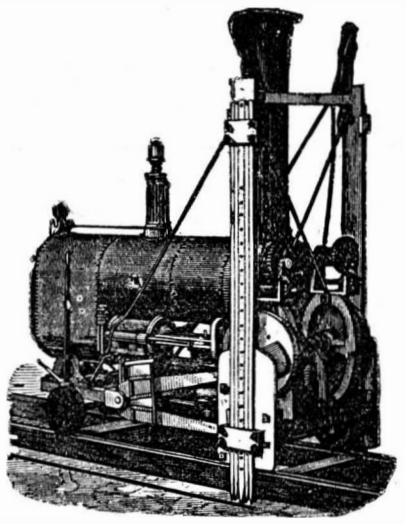

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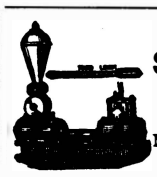

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